OCTOBER • 1949

TOOL & DIE JOURNAL

DESIGN, MANUFACTURE AND USE OF PRODUCTION TOOLING

END MILLS FOR MODERN PRODUCTION

MORE than 800 sizes and types of end mills—the country's largest and most complete selection—comprise the Putnam standard line. Fully-maintained stocks at distributors and factory assure immediate delivery to you of the end mills you may require.

PTC

PUTNAM

TOOL COMPANY

2985 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

IT'S NOT ONLY *Which* CUTTING MATERIAL
But how you use it THAT COUNTS

THERE'S hardly a single cutting operation that can't, in some way, be improved. Our record files contain hundreds of instances. Redesign of the tool itself often works wonders. In other cases, a switch of cutting materials shows a marked increase in production, or in pieces between grinds.

That's the job of our Mill Service organization—to work with you for improvement—and the Allegheny Ludlum line now offers you absolutely complete selection. The range extends from Carmet carbide metal blanks and tipped tools—through ALX cast alloy-metal ground bits—to DBL and Super DBL low-tungsten high speed steels, as well as the various high-tungsten and "moly" types of high speed steels. Call us in, any time, anywhere.

WRITE FOR THE ALLEGHENY METAL "FABRICATION BLUE SHEET"

Contains a wealth of reliable, certified data on the best methods employed in fabrication operations on stainless steel—machining, forming, welding, finishing, etc. Write for your copy—you'll find it highly useful and complete. Address Dept. TD-53.

AL

ALLEGHENY LUDLUM STEEL CORPORATION

General Offices · Pittsburgh 22, Pennsylvania

W&D 627

BELLOWS SENACON NON-ROTATING AIR MOTOR

a different

AIR CYLINDER

with INTEGRAL VALVE *and* OPERATING CONTROLS

For jobs involving pulling, pushing or lifting, there's nothing like the compact simplicity of the Bellows Senacon Air Motor with built-in valve and valve operating controls.

These small, powerful, fast, double-acting, reciprocating power units, perform innumerable operations faster, safer and better than by hand.

Unlike conventional air cylinders with their expensive piping, separate operating valves, separate speed control valves, the Bellows Senacon Air Motor is a complete power unit in itself. Cylinder, operating lever, valve and speed controls are integral. Only one air connection is required, and this can be made with flexible hose.

50% to 600% PRODUCTION GAINS

"Production boosted 400% in cut-off operation."
Detroit

"Production jumped from 350 to 1200 per hour with one air motor."
Grand Rapids

"Air Motor made possible use of girl operator without fatigue."
New York

"Two Air Motors used to permit continuous operation of miller. No time out for loading."
Chicago

"Production increased 600% in wood working application."
Ohio

Write for Bulletin BM 5

Bellows Senacon Co.

798 N. Main St. Akron 10, Ohio

EDITORIAL STAFF

E. Willard Pennington.....Editor
Paul L. Reed.....Associate Editor
Carl F. Benner.....Assistant Editor
Albert W. Ehlers.Contributing Editor
J. S. Livermore....Production Editor
M. W. Paton..Asst. Production Editor
Russell E. Eisenhut.....Art Editor

PUBLISHER
George J. Huebner

Don E. Root.....Assistant Publisher

CBI

Controlled Circulation—CBI Coverage

Tool & Die Journal is published monthly for those industry key men who constitute, in each plant, the Cycle of Buying Influence—CBI—and who are responsible for the design, manufacture and use of production tooling.

Subscription rate: To Schools, Libraries, Students, and other than CBI, $3.00 per year. Single copies fifty cents.

Copyright 1946 by Geo. J. Huebner and R. R. Huebner. Acceptance under the Act of June 5, 1934, authorized October 22, 1942

Official Publication:
The Tooling Institute

REGIONAL OFFICES

Chicago 2.....L. B. Hammond
E. T. Ellington
123 W. Madison St., RAndolph 1843
Cleveland 6 .....Ray L. Huebner
2460 Fairmount Blvd., FA 4040
Detroit 2.....R. F. Pickrell
314 Stephenson Bldg., TRinity 1-0790
Pasadena 1.....M. D. Pugh
35 S. Raymond Ave., RYan 1-6510
New England.....Herman T. Pierik
4 Weybosset Sq., Providence 3
GAspee 5275
New York 17.....H. Thayer Heaton
415 Lexington Ave.
MUrray Hill 2-1647

HUEBNER PUBLICATIONS

Tool & Die Journal · Industrial Plastics
"Die Designing and Estimating"
"Plastics Molds"
The Know-How Library

George J. Huebner...Editor-in-Chief
C. L. Sayler....Manager, Contracts
Paul H. Baisch.....Manager, Reader and Advertiser Services
C. H. Evans.....Secretary
E. O. Hadden.....Chief Accountant
M. D. Klein.....Direct Mail Division

TOOL & DIE JOURNAL

Editorial and Publication Offices
2460 FAIRMOUNT BOULEVARD — CLEVELAND 6, OHIO
FAirmount 4040

Vol. XII, No. 7 October, 1946

CONTENTS

Editor's Blueprint For November 6
Feature Articles Index 75
Editorial 77
Feature Articles 78
Shop Data Sheets 100
Industrial Digest 111
Progress-on-Parade 116
Publication Previews 131
Shop Aids 141
Inform-A-Gram 146A
Contract Tooling and Production 173
The Curb 175
Advertisers' Index 178

Specify

HOLO-KROME

fibro forged

SOCKET PIPE PLUGS

INTERNAL WRENCHING
QUICK & POSITIVE TIGHTENING

SOCKET PIPE PLUG

For all types of steam and hydraulic applications and on motors, refrigerator units, etc., wherever a plug must properly engage the tapped hole to prevent leakage under all conditions . . .

Holo-Krome Socket Pipe Plugs are precision made—jewels of the industry! Here are some facts—(1) Chrome nickel alloy steel. (2) Scientific heat treatment. (3) Truncated threads perfect in lead, pitch and form. (4) True Hex shape uniformly accurate sockets—no taper. (5) Holo-Krome standard of rigid production gauging and checking. (6) Individual hand inspection! . . . Specify Holo-Krome precision Plugs and answer your Pipe Plug problems.

Your Holo-Krome Industrial Distributor is ready to serve you from his warehouse stock.

Unfailing PERFORMANCE

THE HOLO-KROME SCREW CORP. HARTFORD 10, CONN., U. S. A.

Editor's

BLUE PRINT FOR NOVEMBER

Timely • Technical • Tell-how Articles

A TOOLING PROGRAM FOR FORGED GLOBE VALVES PART I
beginning a series on the complete tooling of brass valve bodies; from forging die master blocks, through multiple spindle tools to inspection and finishing setups.

TOOL DESIGN REQUIREMENTS FOR BROACHING BRASSES AND BRONZES
covering broach and broach tooth design for working in these metals; chip behavior and control; product design factors governing successful broaching.

MILLING CUTTER DESIGNS AND GRINDS
describing a program of simplifying the designing and grinding of inserted-blade cutters to insure continuous production through cutter interchangeability.

DEEP DRAWING OF FILTER CASES
the concluding description of the finishing operations on the deep-drawn Fram Oil Filter bodies.

PRECISION PRODUCTION BY MAN-AU-TROL SPACING
a new development by Bullard for the precision locating, by hydraulic control, of workpieces for drilling, tapping, boring and reaming operations, without intricate jigs and fixtures.

KEEP BOTH HANDS ON THE JOB!

Increase Production with a Foot-Power Hydraulic Vise

Here is a PRECISION VISE built for speed, portability and strength. Pressure is HYDRAULIC, applied by foot operation—no time or energy lost through tedious, manual cranking. Ideal for drill press, lathe, milling machine, grinding or bench jobs—for holding, bending, forming, riveting, precision punching and assembling.

CONSIDER THESE OUTSTANDING FEATURES:

1. Constructed of high tensile semi-steel castings.
2. Hardened steel jaw plates for enduring wear.
3. All-steel hydraulically operated foot-control unit.
4. Long base for strong support and extra rigidity.
5. Totally enclosed and shielded ram.
6. Two models—for 4 or 7 ton jaw pressure.

Write direct to manufacturer for further details.

MUNTON MANUFACTURING CO.
FRANKLIN PARK 2, ILLINOIS
— HYDRAULIC PRESSES and VISES —
— RAMS — FOOT-POWER UNITS —

When they ask for
PEERLESS HIGH SPEED REAMERS
TRADE MARK REG. U.S. PAT. OFF.
...THEY GET MAXIMUM TOUGHNESS AT MINIMUM COST
Good tools help any machinist do a better job . . . at lower cost. This explains why there is such a steady demand for PEERLESS High Speed Reamers and the many other CLEVELAND Tools of equally high quality—Twist Drills, Screw Extractors, Arbors, Mandrels, Sockets, Mills, Counterbores, and MO-MAX High Speed Ground Tool Bits and Cut-off Blades.
Handbook for DRILLERS
FREE!
Write to Dept. Y for your copy of the valuable booklet shown above.
Telephone YOUR I S D
The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND 14
CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

FOR 50 YEARS A LEADER

Modern Facilities with The Same Old Skills

THE J. C. Ulmer Company has served American Industry since 1893—developing and building special production machines and other precision tools, gages, jigs and fixtures so vital to low cost mass production.

For over fifty years a leader, The J. C. Ulmer Company has continually acquired the latest, most modern facilities to supplement their years of "know-how" and handed-down skill of their master toolmakers.

Years of successful operation, experienced craftsmen, engineers and management, the most modern facilities and the "habit of precision" are the ingredients that go into every Ulmer-made special machine, tool, gage, jig and fixture.

The J. C. Ulmer Company invites you to submit drawings, specifications or samples for detailed and accurate suggestions and estimates, or if you prefer, ask us to send our representative—there is no obligation, of course.

A catalog listing complete facilities and services available on request.

1893—FACILITIES—1893

1 Foot Treadle Reed Lathe
1 "Pot-Belly" Stove
50 Cigar Boxes of Assorted Screws, Bolts, Nuts
1 Anvil
1 Vise
1 Bench and Chair
Assorted Hand Tools

Master Craftsmanship and "The Habit of Precision"

Master Craftsmanship and "The Habit of Precision"

1918—FACILITIES—1918

Benches for Assembly	1 Landis Grinder
5 Lathes	1 Hardening Furnace
2 Bench Lathes	1 Punch Press
4 Milling Machines	1 Drill Press
1 Hand Miller	Dividing Heads
3 Hand Grinders	

Master Craftsmanship and "The Habit of Precision"

1946—FACILITIES—1946

1-19" x 10' Hendey Engine Lathe
3-16" x 8' Hendey Engine Lathes
2-14" x 6' Hendey Engine Lathes
4 Bench Lathes
2-Schauer Speed Lathes
1-No. 7 B&O Turret Lathe
1-No. 5 B&O Turret Lathe
1-No. 4 W&S Turret Lathe
1-No. 2 W&S Turret Lathe
1-12½ x 20" Monarch Engine Lathe
4-No. 2 B&S Universal Milling Machines
1-No. 22L Van Norman Milling Machine
1-No. 3 Hendey Universal Mill
1-No. 2 Cincinnati Mill
1-No. 2 Reed Prentice Vertical Mill
1-No. 38 Universal Mill
1 Hand Miller
2-No. 3 Cincinnati Mills
1-Bridgeport Milling Machine
2-Bridgeport Vertical Heads
1-24" Hendey Shaper
1-21" Averbeck Shaper
1-12" Hendey Shaper
3-20" Hendey Shapers
1-20" G&E Shaper
1-Cincinnati Planer
1-No. 5 Brown & Sharpe Grinder
1-No. 2 Brown & Sharpe Grinder
2-No. 3 Brown & Sharpe Grinders
1-No. 1½ Landis Internal Grinder
2-No. 13 B&S Universal Grinders
2-LeBlond Tool & Cutter Grinders
2-No. 55 Gallmeyer & Livingston Wet Surface Grinders
2-No. 35 Gallmeyer & Livingston Wet Surface Grinders
3-B&S Surface Grinders
11 Hammond Surface Grinders
1-Majestic Internal Grinder
2-8" Spind'e Delta Drill Presses
1-21" Cincinnati Bickford Drill Press
14-Drill Presses of various sizes
1-No. 6 Swiss Jig Borer
1-No. 31 Lucas Boring Mill
1-JD Continental DoALL Saw
1-No. 26 Continental DoALL Saw
1-3½' Cincinnati Bickford Radial Drill
1-4' Carlton Radial Drill
1-Greb Filing Machine
1-Thiel Filing Machine
2-Oliver Bench Filers
2-Sunnen Honing Machines
1-J&L Comparator
1-Wilder Comparator
1-7½ Ton Electric Crane
1-Sand Blast Cabinet
1-Ingersoll-Rand Air Compressor, 100 cu. ft. per min. Inner and After cooler.

Master Craftsmanship and "The Habit of Precision"

The Habit of Precision Since 1893

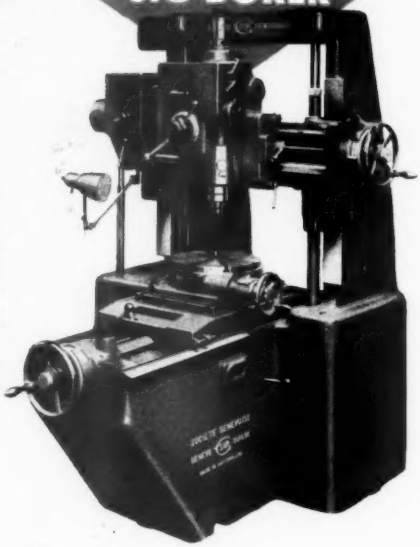
THE J. C. ULMER COMPANY

1791 EAST 38th STREET • CLEVELAND 14, OHIO

Newest

CONTRIBUTION TO HIGH PRECISION IN METAL WORKING!

No. 3K SIP JIG BORER



On the new SIP No. 3K Jig Borer, direct readings can be made to 0.00005 inches—without using separate instruments! All settings are made with built-in measuring devices. Table, spindle saddle and cross-rail are rigidly mounted to preserve perpendicularity, so that accuracy to 0.0002 inches can be maintained over the complete range of operations.

New large table working surface 20½ x 15 inches . . . powerful spindle speeds from 75 to 2000 R.P.M. . . . six automatic table feeds in either direction . . . make the 3K Jig Borer capable of rapid machining over a wide range. For machining very small holes, it can be equipped with a guiding arm holding interchangeable bushes and carried on a scraped prismatic surface on the lower part of the spindle head. When equipped with the SIP tilting rotary table, any combination of rectangular and polar coordinates can be laid out rapidly and accurately.

SIP JIG BORERS RANGE OF TABLE SIZES

Write for full details of the New 3K and other SIP Jig Borers in the following range of table sizes:

No. 2C	18" x 10¾"
No. 3K (illustrated)	20½" x 15 "
No. 4G	27½" x 23⅝"
Hydroptic-B	39½" x 32 "
No. 5G	43⅜" x 32 "

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

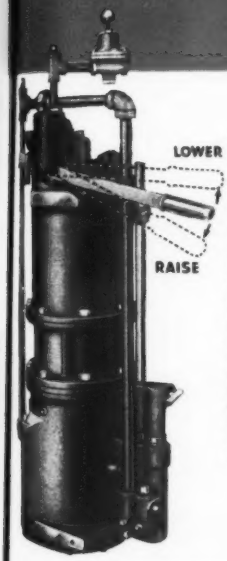
COSA

CHRYSLER BUILDING
New York 17, New York

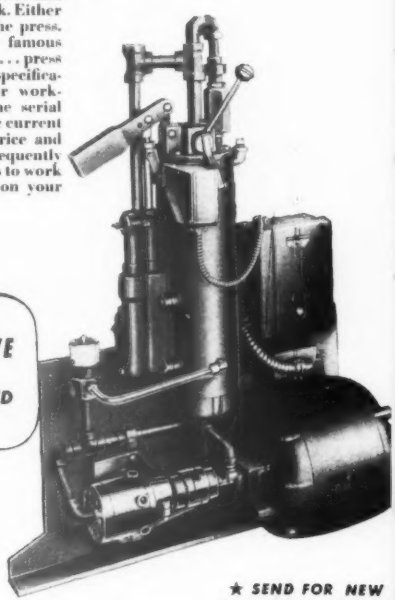
Now... Modernize

YOUR KRW ARBOR PRESSES

. . . FOR HIGH PRODUCTION WITH EITHER AIR-OIL OR MOTOR-DRIVEN POWER UNITS



● Thousands of standard KRW Hydraulic Arbor Presses can now be power equipped for production use by adding the new KRW Power Units. These units . . . either air-oil or motor-driven . . . are available for 25, 50, 60 and 75-ton KRW standard presses. When power equipped, and utilizing simple, inexpensive dies, these standard presses are adaptable to a great many bending, forming, stamping and straightening operations . . . relieving heavier and more expensive equipment for other work. Either type power unit is easily attached to the press. Adding the unit in no wise affects the famous KRW two-speed hand pumping feature . . . press can still be hand-operated. Study the specification table shown here in terms of your work-pressure and motor needs. Give us the serial number of your KRW press and electric current requirements and we will quote you price and quick-delivery date. Put your idle or infrequently used KRW hand-operated Arbor Presses to work where they will pay big dividends . . . on your production line.



THIS IS THE NEW KRW AIR-OIL DRIVE THAT FITS STANDARD KRW HAND OPERATED PRESSES

THIS IS THE NEW KRW MOTOR-DRIVE THAT FITS KRW HAND OPERATED PRESSES

AVAILABLE TONNAGE PRESSURES
25-50-60 TON PRESSES

AIR PRESSURE	7" AIR CYLINDER		9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder	2" Oil Cylinder	1¾" Oil Cylinder
	10 to 22 Tons	14 to 29 Tons	17 to 35 Tons	23 to 47 Tons

75 TON PRESS

AIR PRESSURE	9" AIR CYLINDER	
100 TO 200 POUNDS	2" Oil Cylinder	1¾" Oil Cylinder
	25 to 51 Tons	33 to 68 Tons

KRW Motor Drive develops up to Full Capacity of any KRW Hand-Operated Press.

★ SEND FOR NEW CATALOG . . . IT WILL SAVE YOU MONEY!

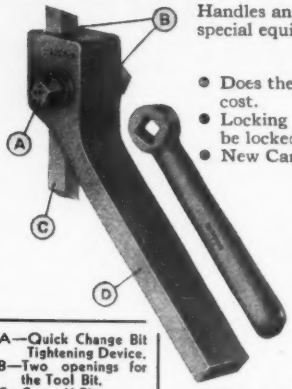
K. R. WILSON, 215 Main St., Buffalo 3, N. Y.
Please send me complete information on 18
☐ KRW Air-Oil Power Units
☐ KRW Motor-Drive Power Units
Serial number of our KRW Press is.....
Voltage..... Cycle..... Phase.....
Firm.....
Address.....
City and Zone..... *State*.....

K. R. WILSON

215 MAIN ST. BUFFALO 3, N. Y.

TOOLS *for* PRECISION PRODUCTION

UNIVERSAL *Precision* TOOL HOLDER



A—Quick Change Bit Tightening Device.
B—Two openings for the Tool Bit.
C—Super X Bit.
D—Special Alloy Steel Body, Drop Forged and Heat Treated.

Handles any and all lathe operations. Also for planer, shaper and special equipment.

NEW EFFICIENCY FEATURES

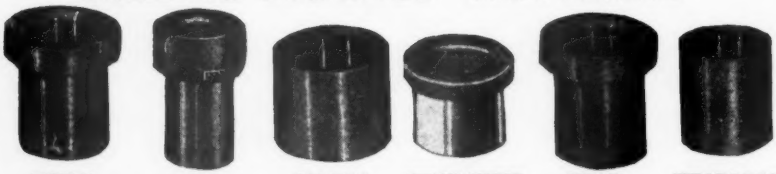
- Does the work of 10 different toolholders—at a fraction of the cost.
- Locking Device has greater rigidity and positive locking. Can be locked in either right or left hand position.
- New Cam Design provides for increased rigidity of the tool bit. Retaining rings provide for easy removal of Cam for cleaning, oiling or replacement.
- Bit and Holder are always parallel.
- Quick change bit tightening device. (See "A".)
- 100% interchangeability of parts.
- High quality ground square Bit and Square Box Wrench furnished with each tool.

SIZES

Holder No.	Holder Size	Bit Size
00	¾ x ¾ x 5½	¼ x 2½
0	⅞ x ¾ x 5½	5/16 x 2½
1	1½ x 1⅛ x 6⅛	⅜ x 3
2	⅝ x 1⅜ x 7	7/16 x 3½

EXTRA LONG BITS and ROUND BORING BARS AND THREADING TOOLS are available for use in the same toolholder.

DRILL JIG BUSHINGS—A.S.A. STANDARD



FIXED RENEWABLE | SLIP RENEWABLE | LINERS | HEAD TYPE LINERS | HEAD PRESS FIT | HEADLESS PRESS FIT

SIMPLIFIED ORDERING: Specify drill size, O. D., and length in order named. Also bushing number.

Bushings above 1¾" hole size will be quoted upon request. In ordering special bushings, forward blueprint showing all dimensions and limit.

These Drill Jig Bushings are made of high grade tool steel—Rockwell C 62 to 64 hardness.

*Special length bushings carried in stock in blank form.

SCREWS

PROMPT DELIVERY • *Write for Literature*

PRECISION PRODUCTION TOOLS

ACME TOOL COMPANY

96 WARREN STREET • NEW YORK 7, N. Y.

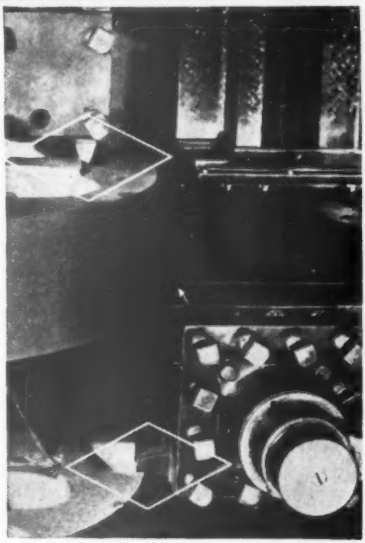
5

times as many pieces per grind —at double the feed and triple the speed with FIRTHITE

CONDITIONS

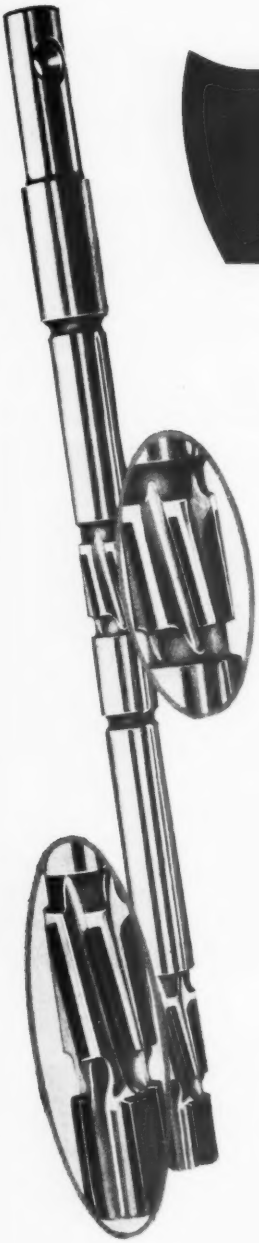
- Depth of cut—1/4" to 3/8" (note intermittent cut over holes)
- Feed per revolution —1/16"
- Cutting speed— 190 feet per minute
- Grade used—Firthite H

Firthite sintered carbide used on this job of turning and facing a cast iron spindle carrier achieved: *greater output* with *increased cutting speed* . . . 190 fpm instead of former 55 fpm; feed per revolution 1/16 inch as compared with 1/32 inch. A significant Firthite case history.



Call **Firth-Sterling STEEL COMPANY**

Offices: McKeesport, Pa., New York Hartford Philadelphia Pittsburgh Cleveland Dayton Detroit Chicago Los Angeles



Now!

CARBIDE-TIPPED TOOLS
BRAZED ON HARDENED
HIGH-SPEED STEEL BODIES

SUBLAND REAMERS
•
LINE REAMERS
•
CENTER DRILLS
•
COUNTERBORES
•
CORE DRILLS
•
END MILLS
•
Special Tools To Your Specifications

AGAIN, Detroit Reamer & Tool Company sets the pace in metal cutting tools, with brazed carbide tips on hardened high-speed steel bodies, so that the total length of the flutes and pilots will Rockwell C-62-63.

It has also been proven in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less "spring-back" under heavy cuts for this same reason. Also, the flutes and pilots will not "score" or pick up due to the hardness of the high-speed steel and long wear on the pilot.

All of these outstanding advantages, together with longer tool life and reduced production costs, are at your disposal with Carbide Tipped Cutting Tools, with HIGH-SPEED STEEL BODIES.

•

MADE TO YOUR SPECIFICATIONS

Write for QUOTATION

•

Detroit Reamer & Tool Co.

2830 E. 7-Mile Road Detroit 12, Michigan

HOW TO GET
BETTER SMALL GEARS
GO to a specialist when you want the best. Whether it's surgery or Small Gears, that same principle applies. When you come to G.S. with Small Gear problems you employ the services of highly skilled craftsmen . . an organization of specialists who have concentrated upon the quantity production of better Fractional Horsepower Gears exclusively for more than 25 years! Here, every conceivable facility is maintained at peak efficiency for doing a better job at low cost. G.S. engineers will lend you valuable aid if you'll just ask for it! Submit your problem today or write for the new G.S. folder.
FRACTIONAL HORSEPOWER GEARING
GS
GEAR Specialties
MEMBER OF
2635 WEST MEDILL AVENUE • CHICAGO 47, ILLINOIS
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

ONE COMBINATION R and L TURNING TOOL *Will Do The Work Of All These For Either Right or Left Hand Operations*

Patented in U.S.A. and Canada

- **Roller Box Tool**
- **Centering and Facing Tool**
- **Knee Tool**
- **Pointing Tool**
- **Back Rest**
- **Floating Drill Holder**
- **Balanced Turning Tool**

Fourteen tools are combined in one R and L (right and left) Combination Turning Tool, the only combination right-hand and left-hand tool on the market.

You can change an R and L Combination Turning Tool from right to left or vice versa in a matter of only ten seconds.

YOU WILL APPROVE THESE OUTSTANDING FEATURES

- **Made of extra tough, heat treated alloy steel; unconditionally guaranteed not to bend or give way**
- **Essential parts ground to extreme accuracy affording perfect alignment at any point of adjustment**
- **Back Rests, or burnishers, have almost diamond hard surfaces eliminating metal pick-up and marring of work surface**
- **Interchangeable Roller Back Rests furnished if desired**
- **Precise adjustment on both cutting tool and pressure of burnishers**
- **Tool bits wear longer because they are ground only on top side, or end**
- **Less cross-slide clearance required; saves time and often permits working with cross-slide tools while turning or drilling**
- **On turnings, the R and L Combination Tool produces highly polished surfaces, true to size, and straight**
- **Usable either for roughing or finishing; extra heavy cuts possible because thrust is always in direct line with Back Rest**
- **Longitudinal adjustment permits turning of two diameters to any length within tool capacity**

All these and many other features are shown by photographs in drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.

R and L TOOLS

1825 Bristol Street

Philadelphia 40, Pennsylvania

HARDINGE *Collets for ALL Lathes and Millers*

Since 1890, Hardinge has symbolized accurate, durable, and low priced collets for all types and sizes of machines. Specify Hardinge collets and you will obtain maximum production efficiency in addition to these extra services:

ONE SOURCE OF SUPPLY

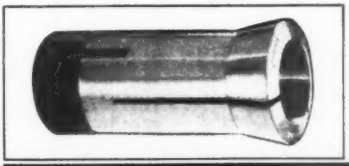
You can standardize on Hardinge Collets and have a complete selection for all makes of lathes.

PROMPT DELIVERY FROM STOCK

Collet stocks are constantly maintained in ten convenient locations throughout the United States: West Hartford; New York City; Elmira; Rochester; Cleveland; Detroit; Chicago; Minneapolis; Los Angeles; and San Francisco. No production hold-ups for Hardinge collets.

SIMPLIFIED ORDERING

Purchasing and Engineering Departments welcome the Hardinge Reference List which simplifies ordering because there is a Hardinge collet for every make of machine.



Take advantage of Hardinge complete collet facilities. Write today for Bulletin 41 which includes the special reference list and describes and prices Collets for all Lathes and Millers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

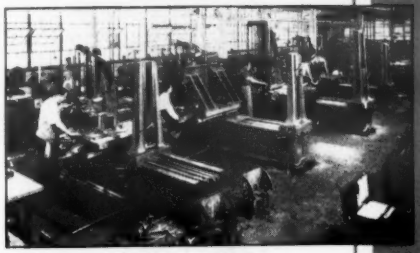
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Check List of McKINNEY CLEVELAND SERVICES

How can we aid you?

Tool Engineering

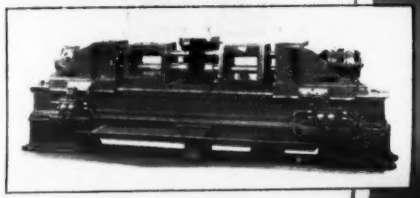
Available for complete tool designing and engineering are a large corps of seasoned specialists whose ability has been proved beyond question. Directing their activities are principals whose entire careers have been devoted with outstanding success to this highly exacting business.



Tool Building

McKINNEY facilities for building tool equipment, as to skilled personnel, plant, machinery and equipment, are unexcelled.

Included are the finest precision equipment available throughout the world and auxiliary units of exclusive McKinney design.



Machine Design

Machine development is closely related to tool design and has been successfully practiced here for many years.

McKINNEY developed machinery contributed greatly to our phenomenal war production records and has been largely responsible for several advanced manufacturing methods and production records.

McKINNEY also builds special machinery to customer's blueprints and specifications.

McKINNEY also builds special machinery to customer's blueprints and specifications.

Contract Machining

The various batteries of metal-working machines in the McKINNEY plant have often been utilized effectively in the quantity production of precision parts for various manufacturers.

Inquiries are invited regarding work requiring turret lathes, milling machines, boring mills, precision grinders and related machinery.

process engineering ·
product design · · ·
plant layout & routing
experimental and · ·
development engineering

Write for Bulletin explaining and illustrating our specialized services and facilities.

Ask a McKINNEY *representative to call and discuss your particular problem.*

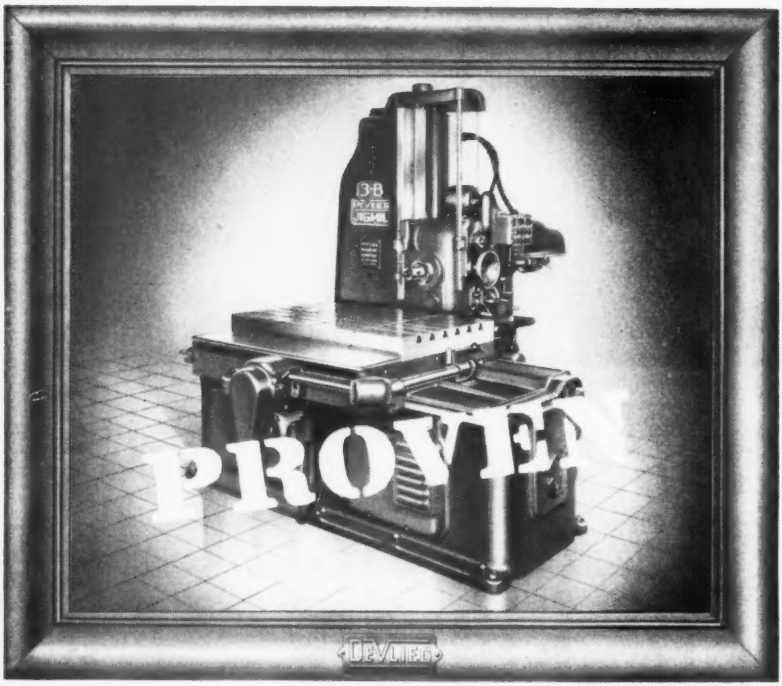
THE McKINNEY TOOL & MFG. CO.

ARABELLA ROAD — CLEVELAND 12, OHIO

DESIGNERS AND BUILDERS OF PRECISION TOOLING SINCE 1920

JIGS · FIXTURES · GAUGES · MACHINERY AND CUSTOM MACHINING

Complete Engineering Service



The World's Finest
Boring and Milling Machine

THIS new model 3-B JIGMIL has automatic power means to position the spindle from one location to another accurately to within much less than .0001 (one ten-thousandth part of an inch). Thus, extreme laboratory accuracy is conveniently available with ordinary skill that would normally make such precision very high in cost. This, and many other refinements, go further to prove that the JIGMIL idea is a totally new approach to the problems of precision boring at a new low cost.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **454 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

Logan A NAME TO REMEMBER WHEN YOU THINK OF **BETTER** LATHES

at these 39 points* this Logan Lathe has self-lubricating bronze bearings

LOCATION	NO. BEARINGS
Underneath Drive	8
Reverse Gear Bracket	2
Gear Box	10
Headstock	7
Automatic Apron	6
Carriage Assembly	4
Turret Assembly	2
TOTAL	39

*All models of Logan Lathes are similarly protected.

SELF-LUBRICATING BRONZE BEARINGS

KEEP LOGAN LATHES READY TO RUN, ADD TO SERVICE LIFE, NEED FAR LESS OILING

The use of self-lubricating bronze bearings in place of plain bearings is typical of Logan Lathe design. The self-lubricating bearings are of a special bronze that is absorbent in texture and impregnated with lubricant. As a shaft revolves in one of these bearings, the lubricant is gradually released in a self-controlled flow which keeps an even film of oil over contacting surfaces. In this way, even though the lubricant is only infrequently renewed, the bearing surfaces are protected. In addition, the spindle on every Logan Lathe revolves on precision preloaded ball bearings that never need lubrication. This sustained lubrication is another factor in the sustained accuracy and long life of Logan Lathes. Get the full story of the advantages offered by the complete line of Logan Lathes from your Logan Lathe dealer, or write for a catalog.

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½" . . . bed length, 43⅛" . . . size of hole through spindle, 25/32" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways, 2 flat-ways.

J-2

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

Double Action

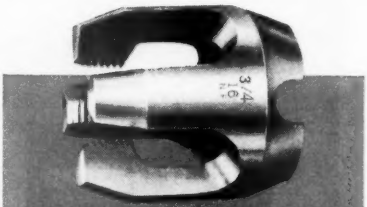
P&W Duocone Dies Assure Perfect Alignment and Provide a Positive Drive

Light . . . Strong . . . Compact . . . P&W Duocone Dies are designed and manufactured for use in automatic screw machines but will function equally as efficiently in semi-automatics, turret lathes and drill presses.

Duocone Dies will lower operating costs by giving maximum service in thread-cutting operations. When used with their proper Die Holders, Duocone Dies assure the operator of proper die alignment and provide a positive drive—"double action"—which increases production on your machines. Reversing Holders for Duocone Dies are available for automatics and releasing holders for semi-automatics, turret lathes and drill presses.

P&W Duocone Dies are the result of many years of laboratory and practical experiment. Correctly designed, scientifically heat-treated, and precision made, Duocone Dies are manufactured in accordance with the P&W principle—"produced under conditions of use". They comply with Pratt & Whitney standards of accuracy.

Write for circular on your firm letterhead.



A Word About Duocone Dies From One of Our Customers

"As you are aware we have used your Duocone Dies over the period of the past four years. These dies have been used in our Automatic Screw Machine Department to cut threads both standard as well as special and in a variety of materials ranging from stainless steel to bronze. In many instances when other means of producing satisfactory threads have failed, Duocone Dies have been the answer to some of our most difficult threading problems.

"We have found your Duocone Dies together with the holders as furnished for these dies by your company to be an exceptionally satisfactory method of producing good accurate threads on high speed screw machines as well as screw threading machines".

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1 • CONNECTICUT

Save Time

ON SHORT RUN MILLING OPERATIONS

by tooling your work on a

GORTON

with

Tracer Control

TRACER CONTROLLED MILLING IS ... SIMPLE ... FAST ... ACCURATE

This illustration shows just one of many applications of tracer control as applied to milling. Gorton tracer controlled equipment includes Duplicators, Pantographs and Electric Arc Etchers for milling, engraving, etching and many other metal removal operations.

Simplicity of operation, high spindle speeds and precision are built-in Gorton characteristics which enjoy enthusiastic approval among thousands of Gorton users throughout the world. It will pay you to investigate Gorton Tracer Control now.

GORTON PRE-DETERMINES RESULTS for YOU

Send us complete description with prints of one of your jobs. Our Engineering Department will send you a production estimate on the same job tooled on Gorton tracer controlled equipment—no obligation.

JOB FACTS

NAME OF PART—*Packaging Machine Cover*

MATERIAL—*Cast Iron*

MACHINE—*Gorton 9-J Duplicator*

OPERATION—*Mill Gasket Groove—10 in lot*

ACTUAL CUTTING TIME—*4½ Minutes each*

CUTTING TOOLS—*Gorton End Mill—10 Pieces per Sharpening*

WRITE TODAY FOR THIS BOOKLET

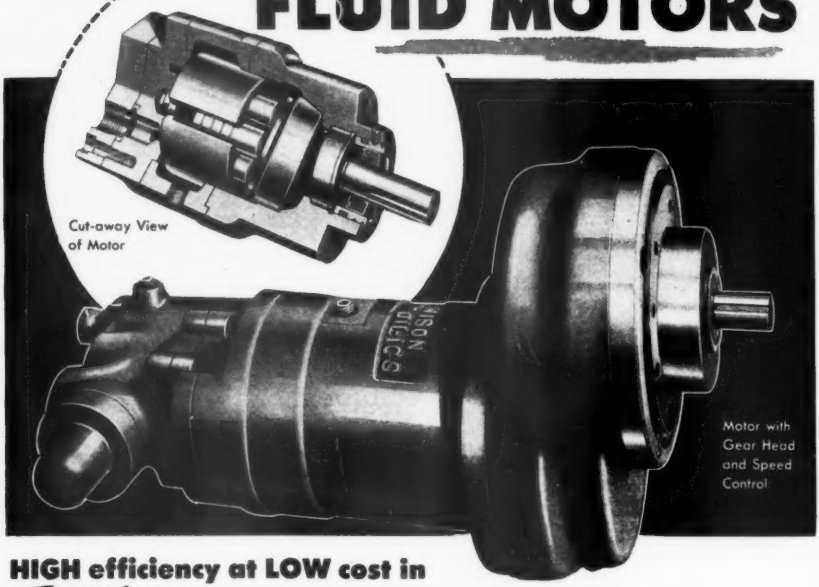
Bulletin No. 1635 will give you complete information on all Gorton tracer controlled machines . . . what they are . . . what they do . . . how they operate, etc. Send for this booklet.

GEORGE GORTON MACHINE CO.

TRACER CONTROLLED MILLING

1210 RACINE STREET • RACINE, WISCONSIN

DENISON HydrOILic FLUID MOTORS



HIGH efficiency at LOW cost in *Fluid Motors* for dozens of needs..

Wherever rotary power can be applied, HydrOILic Fluid Motors offer freedom from shock-load problems . . . stepless speed variation . . . instant speed-up for rapid-traverse needs, and many other advantages!

Their exclusive "floating drive" provides *constant pressure contact* between driving and driven elements, *without mechanical linkages!* Sudden starts, stops or reversals can't cause distortion, breakage, or backlash. Speed of the motors may be pre-set at any rate within capacity, and may be altered as desired while the motor is in operation.

For rapid traverse needs, a plunger interlocked with the speed-control permits instant, temporary acceleration from any pre-set speed to full-speed, for any desired interval.

The motors are fully self-starting and may be stopped, started or reversed at any time without affecting their speed setting or the speed-up control. The motor is completely self-lubricating, and normal slippage circulates oil through the gear-box.

HydrOILic Fluid Motors are available in 3 and 5 h.p. sizes, with or without speed-control and gear-head. Gear ratios—1:3, 3:1, 1:1.5, 1.5:1. Write for details! The Denison Engineering Co., 1197 Dublin Rd., Columbus 16, Ohio.

DENISON EQUIPMENT for APPLIED HydrOILics

FACTS about HOBS and GEAR CUTTERS

Call Your **DISTRIBUTOR!**

Leading distributors in every section of the country have complete stocks of National Cutting Tools. Every National distributor has a factory trained man to serve you. Call your National distributor for cutting tools or any staple industrial product.

Hobs are used for cutting various types of gears, such as spur, spiral, worm, and involute gears, and spline shafts, and for a number of similar applications, where large quantities are to be produced. Single type Gear Cutters are used for small quantity short run jobs where the expense of hobs are not warranted.

NATIONAL makes a complete line of gear cutters and hobs, for every application. All are of the same high standard that has made NATIONAL tools the National choice.

NATIONAL

NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, N.Y. U.S.A.

TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICH., U.S.A.

If you use
DIECASTINGS

THERE'S A *Spot* IN YOUR PLANT FOR A *Lester-Phoenix* MACHINE

- Every manufacturer and diecaster who knows LESTER equipment will find a spot for the *new* LESTER-PHOENIX machine.
- They know that LESTER-PHOENIX diecastings are smooth, dense, low in porosity . . . that LESTER-PHOENIX sets new production records and lowers production cost.
- Partial list of "firsts" on the new LESTER-PHOENIX diecasting machines: One-piece, cast alloy steel frame . . . Largest and strongest die-height adjusting screw . . . Faster die opening and closing . . . Four metal-to-metal columns keep die closed . . . Independent control of both injection speed and injection pressure . . . Highest final pressure until casting chills . . . Positively supported platens eliminate flash — and make better castings for you.

• *Write Today.*
telling what metal you cast and we will send complete LESTER-PHOENIX data.

LESTER-PHOENIX, INC.
2625 Church Ave., Cleveland 13, Ohio

LESTER-PHOENIX
DIE CASTING MACHINES

Copyright, Lester-Phoenix, Inc.

FROM STOCK . . . SUPER MILLING CUTTERS

DESIGNED ESPECIALLY FOR

CAST IRON

AVAILABLE IN ALL STANDARD SIZES

Good news for production men! You can get quick delivery from stock of Super Carbide Tipped Milling Cutters designed especially for cutting cast iron. Available in all standard sizes, these cutters incorporate up-to-the-minute design improvements that cut costs, speed production and improve finishes. For the extra toughness and efficiency of carbide tipped mills plus the advantages of Super Tool engineering and design combined with surprisingly low prices . . . specify SUPER Carbide Tipped Milling Cutters . . . and see the difference!

OTHER SUPER CARBIDE-TIPPED TOOLS FOR

Drilling
Reaming
Countersinking
Turning

SUPER TOOL COMPANY

Carbide Tipped Tools

21650 Hoover Rd., Detroit 13, Mich. 4105 San Fernando Rd., Glendale 4, Cal.

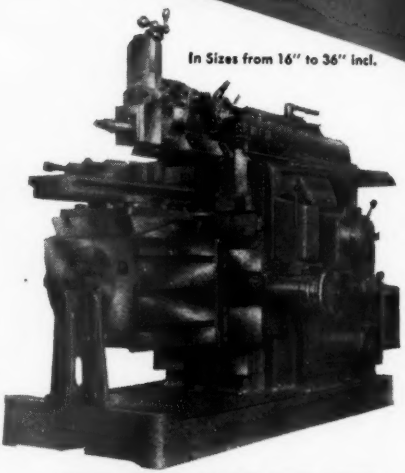
6 Ways to Cut Costs by Increased Production with GEMCO SHAPERS

Appreciable savings in floor-to-floor time can be effected, per work piece, with these tried-and-proved advantages of GEMCO Shapers:

1. **WIDE RANGE OF FEEDS.** Selection of 18 feeds may be made while ram is in motion. Feed-adjusting lever is self-locking.
2. **8 RAM SPEEDS.** Each speed quickly obtained by readily accessible shift levers.
3. **CONTROLS CENTRALIZED** and large easy-to-read dials assure greater convenience for operator, thereby increasing operational speed.
4. **SAFETY HAND WHEEL.** Manual table feed is positively controlled at all times. Eliminates "fishing" for crank handle.
5. **FORCED FEED LUBRICATION.** Fully automatic. Filtered oil continously furnished under constant pressure. Patented "Lubrigard" insures against lubrication failure.
6. **TIME-SAVING ACCESSORIES.** Power Down Feed, Power Rapid Traverse, Concave Attachment, Extended Head, Index Centers, Auxiliary Table.

GENERAL
ENGINEERING
& MFG. CO.

In Sizes from 16" to 36" incl.



GEMCO

Multi-Purpose SHAPERS

THE Universal type of GEMCO Shaper, shown here, is ideal for tool and die work, or where angular setups are required. Its exclusive "Lubrigard" Safety Device increases the precision life.

WRITE TODAY FOR BULLETIN GC-12D

ST. LOUIS 16, MO. *MANUFACTURERS OF PRECISION MACHINERY SINCE 1917*

CHICAGOS
CUT MAN HOURS!
FASTER CUTTING ACTION—Pace setting CHICAGOS, backed by half a century of experience, are skillfully engineered to turn out work in less time, to increase production per man-hour, cut costs!
Come to headquarters for the greatest variety of top quality accessories available . . . mounted and grinding wheels in all grades, grains, shapes and sizes . . . tool and cutter wheels . . . cups . . . internal wheels . . . wheels for center lapping machines . . . drum sanders and bands . . . wire brushes . . . felt and rubber polishers . . . miniature cutters.
You'll find ALL your requirements in the famed Chicago line!

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe St., Dept. TD, Chicago 7, Ill.

Send catalog. Interested in.....

Name .....

Address .....

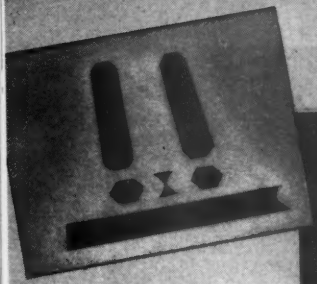
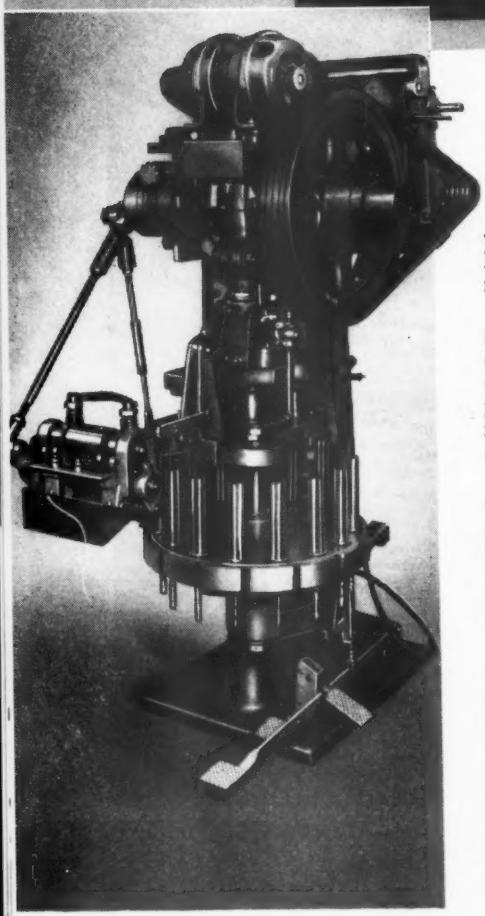


Illustration shows the bomb tail assembly operations performed on this automatic press.

UPS PRODUCTION 500%

ELIMINATES 7 OPERATORS



This special machine, designed and built especially for a local company does things the time-saving way!

To make tails for incendiary bombs was extremely costly in labor, until Barth engineering worked out a faster, more efficient machine.

Former assembly methods called for single operations. The tail assembly cups were blanked and formed from sheet stock, dropped in a tub, sorted, placed into the tube ends, finally formed on another machine . . . in all, too costly in labor.

Now—the Barth-designed and built machine at left makes a complete assembly the quick-and-easy way. Cups are blanked, formed, pushed into the tube, crimped, blown by air from the arbor complete in one automatic operation.

While this unique machine was designed and built exclusively for this operation—the same Barth engineering skill and precision production facilities are as near as your telephone or letterbox. For complex machine problems or high precision production, the Barth organization offer you complete tooling, die, special machinery and designing service of outstanding quality.

DESIGNERS · MANUFACTURERS
DIES · TOOLS · GAUGES · JIGS
SPECIAL MACHINERY

BARTH

STAMPING & MACHINE WORKS, INC.

DENISON AT 34TH STREET • CLEVELAND 9, OHIO

Less SET-UP TIME

More WORKING TIME

. . . FOR YOUR PUNCH PRESS WITH THESE DICKERMAN FEEDS

These accurate, automatic feeds require no connection with the power shaft of your punch press. They save labor time and material waste, both for day-in-and-day-out production and on short runs.

The Dickerman Hitch Feed

1. Feeds from any position on any style die.
2. Saves time on both long and short runs.
3. Offers positive feed control, adjustable from 0" to its limit.

Made in two sizes, 2" and 4" Feeds
Send for booklet

The Dickerman Die Feed

1. Handles coiled stock up to ⅛" thick, widths up to 4".
2. Adjustable from 0" to its maximum feed length in increments of .001".
3. Fasten three screws — and it's mounted on your die set.

Write for booklet

H. E. Dickerman Mfg. Co.

3211 TO 3221 ALBANY STREET SPRINGFIELD, MASS.

NEW

Single-Unit Motor-Driven

20" ROTARY TABLE

- Eliminates all set-up time.
- May be used on any make of milling machine or horizontal boring mill.
- Plug it into the nearest light socket and it's ready to go.

Write for Complete Information

W. B. KNIGHT

MACHINERY COMPANY

KNIGHT MILLERS — VERSATILE · ACCURATE · RIGID

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

A plant inspection at your fingertips

Are you acquainted with Star's facilities? Star offers you a handsomely prepared 46-page booklet describing completely the experience, craftsmanship, and facilities that have led many of America's leading manufacturers to tool at Star—tomorrow's products.

Star is completely equipped with the most modern machine tools to build your dies, jigs, fixtures, gages and special machinery to produce your products better, faster, more economically.

In addition to outstanding custom tool and die work, Star maintains unusual production facilities operated independently of their tool and die shop. Star is equipped to start from your blueprint or sample and carry your job through tooling to final assembly.

Use the coupon below to assure prompt mailing of YOUR COPY of Star's "Plant Facilities", or better still, write Star specifically about your tooling or production problem.

STAR MACHINE & TOOL CO.

9320 Woodland Ave. • Cleveland 4, Ohio

• Phone: GArfield 2060 •

Detroit Office: 651 Book Tower

Custom Tool and Die Makers

ADMIT ONE . . . TO INSPECT FACILITIES AT STAR

Please send your brochure "Star Plant Facilities" to

Mr......

Title.....

Company.....

Address.....

Clip and mail to Star Machine & Tool Company, 9320 Woodland Avenue, Cleveland 4, Ohio

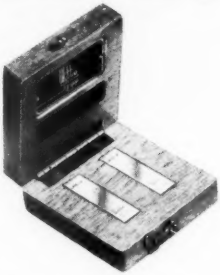
REPLACE DOUBT WITH *Confidence*

The uncertainties arising from a questionable reading or feel of micrometer or caliper can affect not only precision but peace of mind, too. Make Webber Gage Block inspection a compulsory procedure on all critical measurement. Encourage accuracy by making them easily accessible.

Speeds Layout, Inspection

Layout and inspection work has been speeded up through the application of Webber Heavy Duty Gage Blocks. The patented clamps and holding fixtures can function as a temporary snap gage, inside and outside caliper and precision scriber. No longer is it necessary to wait for special purpose gages in tooling and set up.

Angle Accuracy Webber Angle Gage Blocks provide a brand new approach to angle measurement. Accuracy rarely obtainable in traditional shop methods is now possible. Simple and compound angles can be measured quickly. Accuracy in degrees, minutes and seconds are assured as the proof is contained within the blocks themselves.



***Carblox* for wear** Webber Carblox wear gages are specifically designed to permit frequent use of master gage blocks without exposing them to excessive wear. The hard carbide surface of carblox withstands daily use for many months with virtually little wear. Prices begin at $21.50 for a set of two with case.

Write for details, Webber Gage Co., 12903 Triskett Rd., Cleveland 11, O.

WEBBER MAKES PRECISION GAGE BLOCKS EXCLUSIVELY

- ★ Gage Block Sets in Steps of .00005"
- ★ Individual Special Size Blocks.
- ★ Heavy Duty Gage Blocks.
- ★ Angle Gage Blocks in Steps of one second.
- ★ Carblox (Carbide) Wear Gages.

Webber
PRECISION
GAGE BLOCKS

SAVE TIME 4 WAYS WITH ONE TOOL

HEAVY DUTY
MODEL 4

INSIDE NIBBLING SHEARING DRILL ROD CUTTING

THE HEINRICH

HANDNIB

FOR

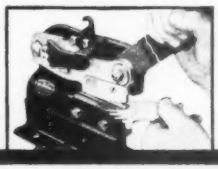
- ✔ OUTSIDE NIBBLING
- ✔ INSIDE NIBBLING
- ✔ SHEARING
- ✔ DRILL ROD CUTTING

• The Heinrich "Handnib" enables tool makers to speed up cutting of templates, trial blanks, experimental pieces, etc., into any irregular shape. Saves hours of slow, hand work. Double crank construction makes the Heavy Duty Model 4 "Handnib" the easiest hand-operated nibbling-shearing tool on the market. The frame is cast steel, and all wearing parts are hardened and ground for life-time service. Nibbles inside and outside and shears flat stock up to 3/16". Cuts round stock up to 3/8". Inside nibbling depth of cut, 4" from any edge. May be clamped in a bench vise or mounted on a bench. Write for descriptive folder with full information on this and other Heinrich "Handnib" models.

★ ★ ★ FOUR OTHER HEINRICH TIME SAVERS ★ ★ ★

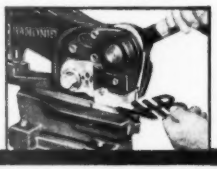
Model 1 • For Shearing only. Capacity up to 1/8" flat stock.

Model 2 • For Outside Nibbling and Shearing of flat stock up to 1/8".



Model 3 • Same as Model 4, but capacity up to 1/8" flat stock.

Model 5 • An inside and outside nibbler, shear, rod cutter, punch.



NATIONAL MACHINE TOOL COMPANY

MANUFACTURERS OF "GRIP-MASTER," THE WORLD'S FASTEST VISE

DEPARTMENT 136-K • **RACINE, WISCONSIN**

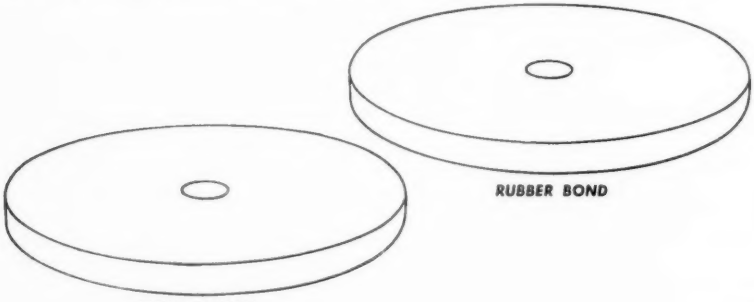
Who really knows

Your experience tells you this is a tough one to answer. You've seen what correct bond selection means in faster, better grinding at less cost. You know the importance of the right bond in terms of maximum cut with minimum pressure and lowest wheel loss.

You have probably seen one of your own shop experts worried with what seemed a logical choice. For, there's plenty of room for error in evaluating the many variable factors involved.

For instance, the speed of the grinder, tolerance limits, or production schedules are but a few of many factors to be considered. Yet, neglecting one...even partially...will upset the calculated performance of the wheel you choose.

To help you make the best choice of wheels, CARBORUNDUM has organized a system of checks and balances. It offers you a practical service...service easy to use...service depended on by many successful concerns.

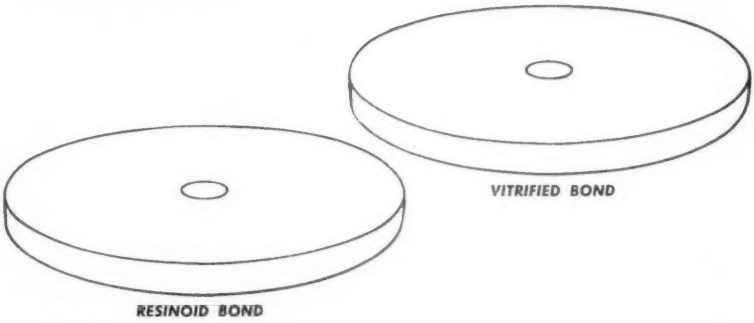


RUBBER BOND

SHELLAC BOND

A good rule for good grinding... **CALL**

what bond is best?



CARBORUNDUM salesmen and our distributor's representatives are your contact with this service. They are familiar with your needs. They are informed on latest abrasive developments. Supporting them in the field are our Abrasive Engineers...qualified to solve tough grinding problems. And here, in the modern laboratories of CARBORUNDUM, are scientists and technicians probing grinding practices in the light of abrasive development. As a result, they usually come up with the most direct solution to difficult grinding problems.

There is no better way to find out what bond is really best, or what wheel to use, than to depend on this organized service. It is a smooth working combination of knowledge and experience. Call in CARBORUNDUM. There is no surer means of making certain you are getting the best. The Carborundum Company, Niagara Falls, New York.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones

Sticks, Stones & Rubs

Specialties

COATED ABRASIVES

Paper, Cloth and Combination

Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:

Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

PRODUCTO HAND TAPPERS

The one machine needed in every tool, die and machine shop. Will save its cost many times over. Designed for toolroom work to close limits. Built to withstand hard shop use. Quickly adjustable to position taps at any place on table. Now made in 3 sizes... 2 bench types, capacities 1/4" and 1/2" taps; and Universal Pedestal type, capacity 1" taps. Once in your shop, you will never be without it. Write for descriptive bulletin.

THE PRODUCTO MACHINE CO.

990 Housatonic Ave., Bridgeport 1, Conn. o Bridgeport 4-9481

PRODUCTO SERVICE IS ALWAYS AT THE PHONE ON YOUR DESK

NEW YORK 12,
197 Lafayette St.
Worth 4-7484

CLEVELAND 14,
5345 St. Clair Ave.
Express 1133

DETROIT 11,
3017 Medbury
Plaza 3101

INDIANAPOLIS 2,
635 Fulton St.
Lincoln 5385

LOS ANGELES 21,
2168 E. Olympic Blvd.
Trinity 7827

SOUTH BEND
Precision Lathes

RUGGED
ACCURATE
DEPENDABLE

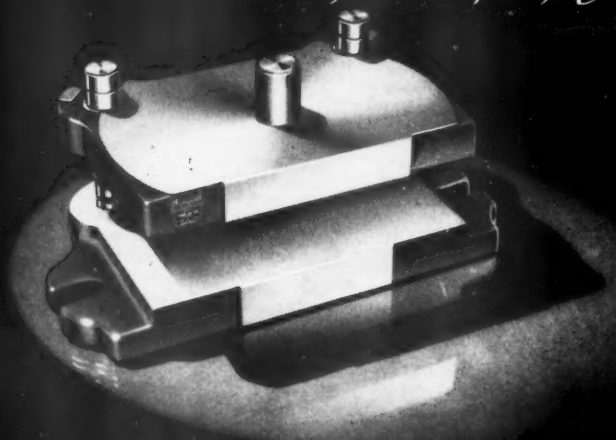
The rugged construction of South Bend Precision Lathes is best demonstrated by the fact that the great majority of all South Bend Lathes ever made still are giving satisfactory service after years of daily use. Their rugged construction explains why, even after many years of service, they continue to produce toolroom and production work to close tolerances. It explains why they have earned for themselves a reputation for dependable performance in all types of installations. Because of their rugged construction, lifetime accuracy, dependability and unusual versatility, you will find it to your advantage to specify South Bend Precision Lathes for your next installations. Write today for Catalog 100-D which illustrates all South Bend Engine Lathes, Toolroom Lathes, and Turret Lathes.

LATHE BUILDERS SINCE 1906

SOUTH BEND LATHE WORKS

432 EAST MADISON STREET • SOUTH BEND 22, INDIANA

Die Sets for Every Stamping Job



Our constant endeavor to deliver a better product is the basis of our ever-increasing volume of business. We invite your inquiries regarding all-steel and semi-steel standard and special die sets; dowel pins, cap screws, die springs and other accessories.

CALL "DETROIT"

DETROIT	TR 2-5150
INDIANAPOLIS	LI 3884
MINNEAPOLIS	AT 5264
DAYTON	HE 3048
TOLEDO	GA 5706
SEATTLE	SE 2090
PORTLAND, Ore.	AT 1466
SAN FRANCISCO	MA 8532
BUFFALO	PA 9206
PHILADELPHIA	VIC 4084
ROCK ISLAND, Ill.	RI 743

DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SETS ★

Size and Finish Holes with Precision in Steel, Cast Iron, Bronze, Copper, Aluminum, Plastics, Ceramics, Glass *with the*

SUNNEN PRECISION HONING MACHINE

You can finish almost any kind of metal except lead or babbitt to within .0001" with the Sunnen Precision Honing Machine. In addition, you can produce any commercial finish required to meet your specifications. In hardened steel, finishes can be held to .00005" on a production basis. Comparable finishes can be produced in other materials, when necessary.

These finishes can be produced in a wide range of sizes, too—from .125" to 2.625" in diameter.

This type of precision workmanship means longer life for parts, fewer rejects and greater interchangeability of closely mated parts.

The Sunnen Precision Honing Machine is quickly and easily set up—easy to operate—requires no jigs or fixtures—is low in cost and economical to use.

A Sunnen engineer will be pleased to tell you how Sunnen honing can be used to your advantage, in your plant. Call him in—or write direct for free illustrated bulletin. If you have sample parts, send them—with specifications—to the Sunnen Honing Laboratory for a test run.

SUNNEN PRODUCTS CO., 7947 Manchester Ave., St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

SUNNEN

Typical Jobs

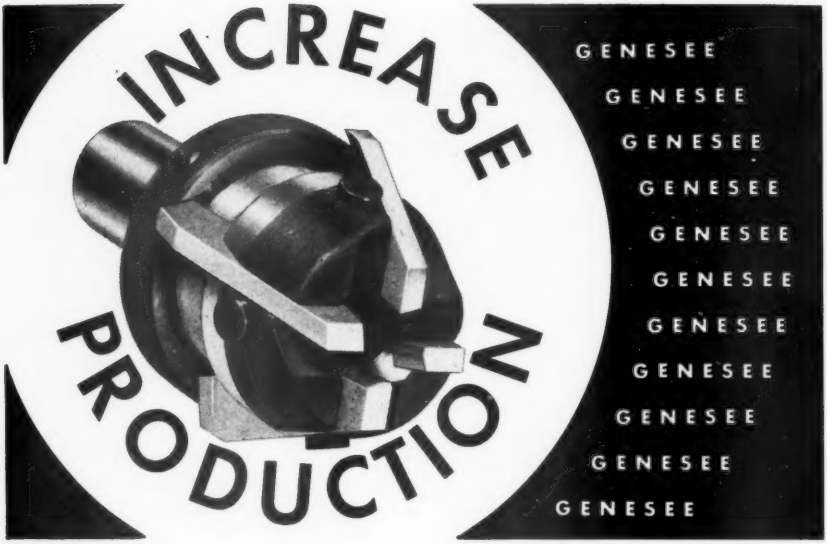
Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Aircraft Valve Guide. Valve tappet roller pin hole honed to 6 micro-inch finish.

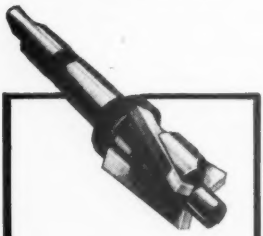
Bearing. A very small part. 2 micro-inch finish necessary.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.



ADJUSTABLE HOLLOW MILLS



Other Genesee tools that will increase production.

•

Inserted Blade FACING AND COUNTERBORING TOOLS

•

SPECIAL PRODUCTION TOOLS

There is a Genesee for every hollow milling job. Available in 16 styles. Standard sizes from 0 to 2", with straight or Morse taper shanks carried in stock . . .

- Each size tool has 1/8 range.
- Blades quickly ground in a simple fixture.
- All tools manufactured of heat-treated alloy steel.
- Adjusting threads are ground from the solid and adjusting rings are lapped for extreme accuracy.
- Furnished with high speed steel, cast-alloy, or Tungsten Carbide tipped blades.

Let our Engineering Department solve your Production Tool problems.

Write for catalog 45-J

GENESEE MFG. CO., INC.
GENESEE
EST 1908
ROCHESTER 4, N.Y.

ADJUSTABLE HOLLOW MILLS • FACING AND COUNTERBORING TOOLS • SPECIAL PRODUCTION TOOLS

Screen Out Rejects With AXELSON GAGES

For thirty years, the Axelson Manufacturing Company has demonstrated, to an exacting trade, its ability to produce precision Gages. Today, *Axelson* offers a wide line of Standard Gages as well as facilities to manufacture any Gages for specialized requirements. All these gages are manufactured in the most modern and scientific manner with temperature controlled conditions so that even the atmosphere cannot minutely affect the gage in the making. For *any* gage requirements call on *Axelson* where quality-first standards bring you as close to perfection as is humanly and mechanically possible in this all-important requirement.

AXELSON MANUFACTURING CO.
6160 So. Boyle Ave. (P.O. Box 98, Vernon Sta.) Los Angeles 11, California, U.S.A.

AXELSON GAGES

PLASTIC DIPPED PROTECTION KEEPS THEM NEW!

● Here are two ring gages, one shown dip-protected to insure perfect condition when delivered. The other picture shows protective coating partly removed, the gage bright and shining underneath.

Continental

COUNTERBORE SETS

A Size For Every Purpose

CONTINENTAL Interchangeable Counterbores are now available in a choice of three sets, each providing a wide variety of useful, dependable tools. In complete yet compact form, you will find a selection designed to fill the needs of the large or small toolroom. Set No. 1 (illustrated), for the small shop, includes cutters up to 1 1/16" diameter, with two holders. Whichever set you choose, you will get fine, precision-made cutting tools.

THE indestructible drive and rigid, yet simple, construction of the Continental Interchangeable Counterbore assure long dependable service.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CTW

Continental

CUTTING TOOLS

- Boring Bars and Tools
- Broaches Broach Pullers Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

46-44

You'll get peak production

AT A PROFIT — with the *Mona-Matic**

Fully automatic cycle—or fully manual —or any combination. Between-centers work as fast as carbide tools and modern metals can take it—spindle speeds up to 1000, 2000, 3000 and even 5000 RPM.

That's the kind of work you can do on the Mona-Matic. You'll get floor-to-floor time you'd ordinarily think of only in connection with specialized, one-purpose machines—and at the corresponding low machining costs usually restricted to mass production methods.

Yet, with the Mona-Matic, you'll have an almost universally adaptable machine. The front carriage is built with power feed and rapid traverse return; the independent, electrically controlled rear slide may be added as a separate unit.

* MONA-MATIC—Add this new name to your metal-turning dictionary—You'll be hearing a lot of it—wherever rising production costs are a factor. The *Mona-Matic* is Monarch's answer to this problem in the field of between-centers work. Get full details *now*—from your nearest Monarch representative—or write us direct.

The Monarch Machine Tool Co.
Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

Bunell Announces
PLANT CHECK-UP SERVICE

IMMEDIATELY EFFECTIVE, The Bunell Machine and Tool Co. offers a new Outside-Plant-Engineering Service for industry. This is in addition to its tool, die and special machine engineering, designing and building services at its plant, and is on the same charge basis as these regular services.

THE COMPANY WILL ANALYZE and review equipment and processes in individual plants, to determine solution to problems. Trained observers—Bunell technicians who are experienced in "how-to-do-it" techniques—make the necessary check of procedures and machines.

THE IMPORTANCE OF THIS Bunell plant service is apparent. There is a direct analogy between the periodic physical check-up of the individual to determine the state of his health and the seasonable factory check-up to determine the status of operations and methods.

It is not a substitute for the services offered by management engineering firms. It is used by both industry and management consultants.

IT IS AN INSURANCE SERVICE to safeguard against expensive mistakes—to get rid of unnecessary complexities in the manufacturing operation. It's a readily available service of simplification—a "man Friday" service of expert help.

Whether the program wanted is complete or only a departmental survey, it is relatively inexpensive—a test of every probability for profitable improvement. Ask about it.

THE BUNELL MACHINE & TOOL COMPANY

1601 EAST 23rd STREET · CHerry 0343 · CLEVELAND 14, OHIO

SHELDON Vernon

Now Available!

Coming off the new production lines in Chicago, the SHELDON-built SHELDON-Vernon Precision Machine Tools* are now available at the same moderate prices that made them first in the moderate priced field. Built in the new, modern SHELDON plant, which is equipped with every advanced machine tool building facility, they are better than ever—even more accurate, more rugged and better finished. Lighter and smaller and less costly than machine tools of equal accuracy, they provide a faster, more convenient and economical means of doing all but the heaviest operations.

Write for Bulletin on:

- ★ **SHELDON-Vernon Horizontal Milling Machine**
- ★ **SHELDON-Vernon Vertical Milling Machine and Jig Borer**
- ★ **SHELDON-Vernon 12″ Shaper**

See the new SHELDON Machine tools at Space No. A183 National Metal Congress, Atlantic City, November 18 to 22.

Builders of Good Lathes Since 1919

SHELDON MACHINE CO., INC.
4236 N. Knox Ave., Chicago 41, U.S.A.

Feeling a tap's pulse

Visitors to the "Greenfield" plants are amazed at the laboratory techniques that are now a part of modern threading tool and gage manufacture. Surrounded by every device for the measuring and testing of precision tools, "Greenfield" metalurgical scientists and technicians keep tabs on "Greenfield" products every step of the way from the raw stock to the finished product.

In these metallurgical "clinics," they check the chemical composition, the microstructure, the hardness, the toughness, and the wear resistance. Because of such vigilance, users of "Greenfield" tools get *more for their money* in threading tool performance.

GREENFIELD TAP and DIE CORPORATION
GREENFIELD, MASSACHUSETTS

SHOWS ALL...
TELLS ALL

NEW JKS INDUSTRIAL DIAMOND TOOL CATALOG

With pictures, diagrams, figures and facts, the new JKS Industrial Diamond Tool Catalog is off the press and ready to show you how to get maximum results from diamond tools . . . why they are piling up savings in time and money for so many types of industry today.

This 64-page plastic bound catalog offers you interesting and helpful information on diamonds themselves and all types of JKS industrial diamond tools. Twenty pages are devoted to JKS Standard Tools, adaptable to 73 different makes of machines . . . listed by the equipment manufacturers' name. Send for your free copy of this useful catalog on your company letterhead today.

J. K. SMIT & SONS, Inc.

157 CHAMBERS ST., NEW YORK 7, N. Y.

SOCKET HEAD CAP SCREWS

In tooling jigs and fixtures "ALLENS" are the universal screws, either for powerful clamp set-ups or fine, precise adjustments. Their strength of head and accuracy of thread are achieved by Allen *pressure processes* that eliminate weaknesses caused by cutting the stock.

The above view was taken in the toolroom of Douglas Aircraft Company, Santa Monica, Calif. In small tooling jigs like the one above and equally in the heaviest welding fixtures, "Allens" have the *clamping-power* to depend on! Threads are accurate to a high Class 3 fit, for a maximum of frictional holding-power in the tapped hole. Internally engaging hexagon keys are obviously the handiest of wrenches for this work. Ask your local Allen Distributor for samples or demonstration.

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, ★ ALLEN ★ CONNECTICUT, U. S. A.

Photograph courtesy Black & Decker Mfg. Co.

HERE *you need an*

ARMOURCLAD FIBRE COMBINATION DISC!

Armour Abrasives Help You Do Your Jobs Better

For better, faster finishing you'll need the fastest tools and the best abrasives possible.

In any operation . . . in cutting welds . . . in removing burrs . . . in leveling metal surfaces . . . there are *specialized* ARMOUR ABRASIVES *designed to do a better job at less cost.* The faster, sharper, cooler-cutting *Armourclad Fibre Combination Disc* is only one of Armour's *complete* line of better metal-working abrasives.

It will pay you to call on Armour's experienced technicians. They will gladly help you choose the abrasives and methods which do your jobs best.

ARMOUR *Sandpaper* WORKS

DIVISION OF ARMOUR AND COMPANY

1355 West 31st Street • Chicago 9, Illinois

HEAT TREAT SMALL PARTS

In Your Own Plant

ESSENTIAL FOR TOOL AND DIE SHOPS

You save time and money heat treating small tools and dies in a Cooley Electric Furnace. Uniform temperatures are maintained throughout the furnace chamber to assure even heating of parts. The heating elements are embedded in refractory materials, protecting against atmospheric attack. They are easily replaceable.

ECONOMICAL TO OPERATE

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

More Profitable Reasons for Using Cooley Furnaces

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalized and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Vertical Lift Door — Counter weighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand — For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

AVAILABLE IN TWO SIZES

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$146.00*
MH-4	10″W 6″H 18″L	.....	4800	20.9	$222.50*

*Includes Hearth Plate

MAX. SAFE TEMPERATURE — Continuous operation, 1750° F.; Intermittent operation, 1850° F.
AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

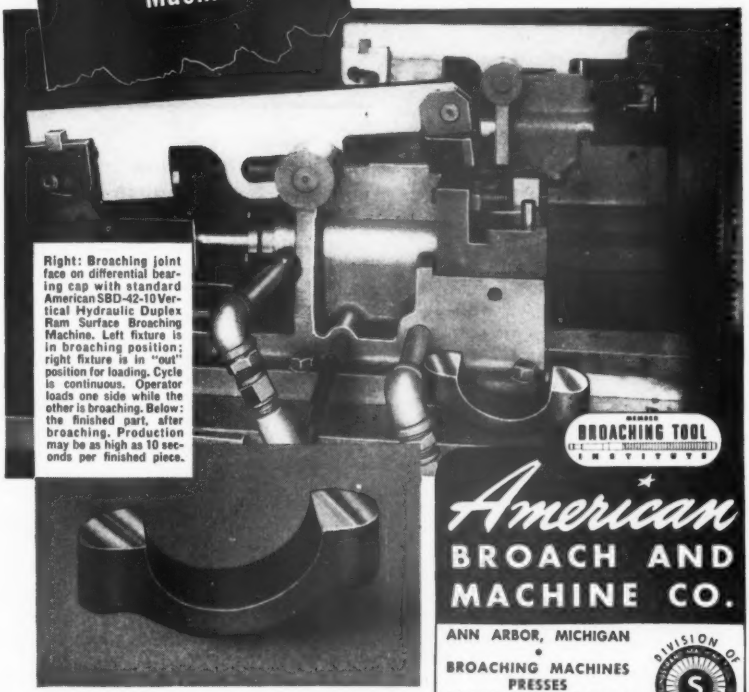
COOLEY ELECTRIC MANUFACTURING CORP.
32 South Shelby Street Indianapolis 7, Indiana
INDIANAPOLIS MACHINERY EXPORT CORP.
Export Manager, 44 Whitehall Street, New York, New York

Faster Loading

Through Automatic Clamping on *American* Duplex Ram Surface Broaching Machine

FASTER loading means higher production—and you can get both with *American* Vertical Hydraulic Duplex Ram Broaching Machines. Uniform hydraulic clamping of parts makes loading fast and uniform, with minimum effort for the operator. Electrical controls and continuous cutting operation also contribute to maximum output at minimum unit cost. Every stroke is a cutting stroke due to alternate action of the two rams.

Engineered by *American* as the answer to many mass production problems, the Duplex Ram Broaching Machine is only one of a complete line of *American* machines and tools for metal finishing. Whatever your forming or finishing job, let *American* engineers recommend the right equipment for top efficiency. This is part of *American's* complete broaching service—machines, tools and engineering. Ask for complete details today!



Right: Broaching joint face on differential bearing cap with standard American SBD-42-10 Vertical Hydraulic Duplex Ram Surface Broaching Machine. Left fixture is in broaching position; right fixture is in "out" position for loading. Cycle is continuous. Operator loads one side while the other is broaching. Below: the finished part, after broaching. Production may be as high as 10 seconds per finished piece.

MEMBER BROACHING TOOL INSTITUTE

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

•

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

Postwar Products Use

BALL BUSHINGS

FOR LINEAR MOTIONS

- **Reduce Wear**
- **Reduce Friction**
- **Reduce Power Consumption**
- **Reduce Lubrication**
- **Reduce Maintenance**
- **Reduce Cost of drive motors, gears, linkages, etc.**

The use of ball bearings for rotating parts is unquestionably profitable — a time tested fact! The economies and many other advantages of anti-friction bearings can now be obtained for linear motions.

Free rolling unlimited travel BALL BUSHINGS cannot cock or bind and will maintain almost frictionless precision alignment. Perhaps the size, weight and cost of your entire mechanism can be substantially reduced by application of BALL BUSHINGS.

Investigate their advantages to you! Write for literature containing standard sizes, engineering data and the Twenty Advantages of BALL BUSHINGS.

THOMSON INDUSTRIES, INC.

Dept. D, 29-05 REVIEW AVENUE • LONG ISLAND CITY 1 • NEW YORK

FRICTION COSTS MONEY

ROLL IT — DON'T SLIDE IT

AMMCO

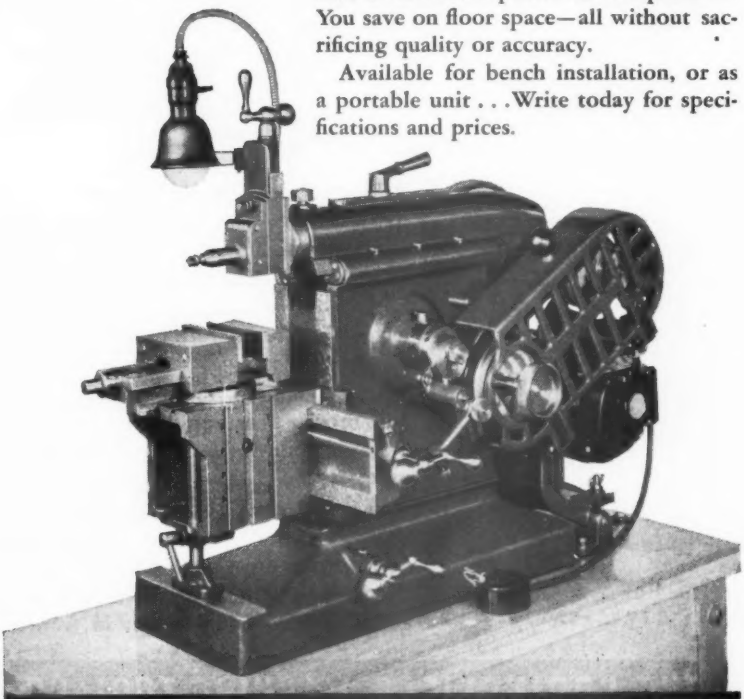
7″ SHAPER

--A precision machine meets postwar needs for accuracy, speed and economy

If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

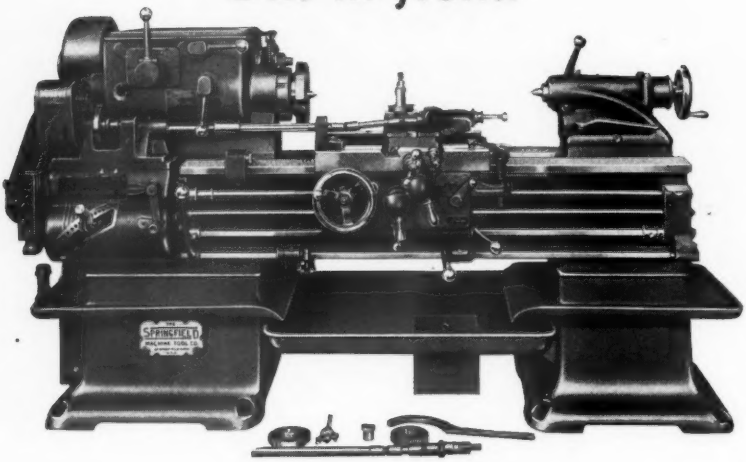
Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



AMMCO 2100 COMMONWEALTH AVENUE NORTH CHICAGO, ILLINOIS

SPRINGFIELD PRECISION LATHE

Out in front!



SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive.
Bed . . . permanently true — made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy — operates on Ball and Bronze bearings throughout.
Taper attachment . . . hair-trigger adjustment.

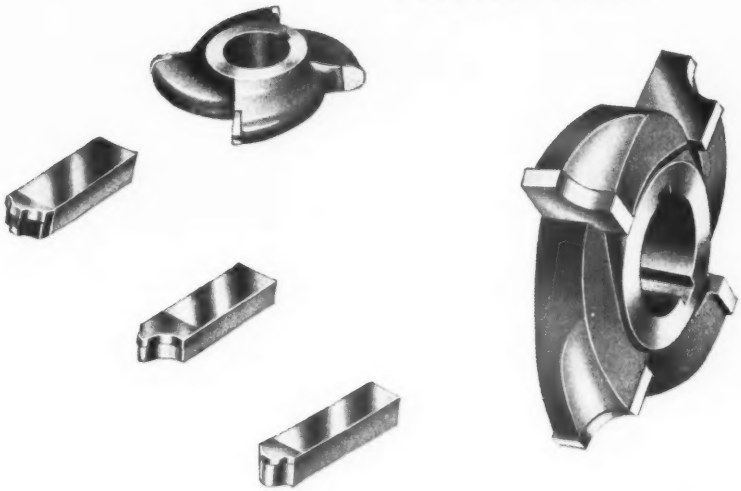
Compound rest . . . sturdy, firm.
Tailstock . . . all bearings and bed ways oiled from one well.

From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

THE SPRINGFIELD MACHINE TOOL CO.
SPRINGFIELD • OHIO, U. S. A.

STEP UP PRODUCTION 500%

With Meyers Carbide Tipped Formed Tools



On actual production runs, Meyers generated Carbide Tipped Tools have boosted production more than 500%.

This amazing increase was due to use of special Meyers equipment designed and engineered by our Engineering Department. Increased costs force you to get the most out of your machine tools—Meyers generated carbide tipped form tools will give you more pieces per hour—more pieces between grinds—and a much smoother finish. Let us help you improve your production and cut your costs. Send us your prints for quotation.

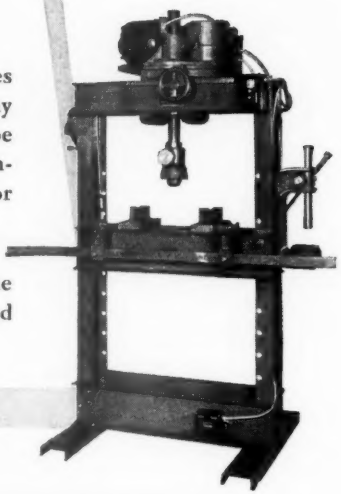
W. F. MEYERS COMPANY, INC. • *ESTABLISHED 1888*

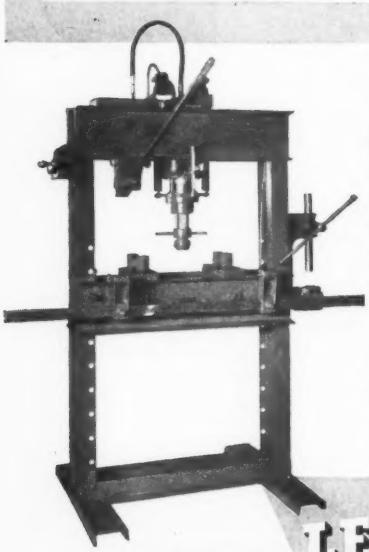
1016 FOURTEENTH STREET • • • BEDFORD, INDIANA

Save Time.. Save Labor

WITH LEMPCO PRESSUREMATIC PRESSES

Lempco Pressurematic Presses will pay for themselves many times in your shop. They can be used for press fitting, assembling, bending, straightening or die tryouts. Pressurematic Presses are made in Electric and Hydraulic models. Pick the one that fits your needs and place your order today.





LEMPCO ELECTRIC PRESS

Speed . . . power . . . economy . . . make the Lempco Electric Press the outstanding machine of its kind. Available in 20, 40 and 60 ton models. Foot controls free operator's hands for any operation. Builds up from zero to 60 tons in just 4 seconds. Automatic Pressure Control available for this press. Prevents excessive pressure which might damage work. And it also permits press to be used for production runs.

LEMPCO HYDRAULIC PRESS

Two pumping speeds . . . adjustable work head on 60-ton model for easy centering over work . . . long ram travel . . . and other fine features make the Lempco Hydraulic Press the most efficient hand-operated press on the market. Made in 40 and 60 ton models.

5713 DUNHAM ROAD
BEDFORD, OHIO

LEMPCO

Write for free book *that tells how, when and where Lempco Pressurematic Presses can be used to your greatest advantage.*

A New Heavy Duty "PLUNGER" Clamp

by DE-STA-CO

No. 610

Plunger travel 1½"

Designed for locating and indexing, or comparable operations, of relatively heavy work. Can be switched from "Push" to "Pull" action in a few seconds. Plunger rod tapped to receive standard ⅜"-16 bolt. Overall length, (in "Push" position) 6¾". Weight 1½ lbs. Rust-resistant finish. De-Sta-Co clamps are the simplest means for securing work in jigs and fixtures through production and assembly.

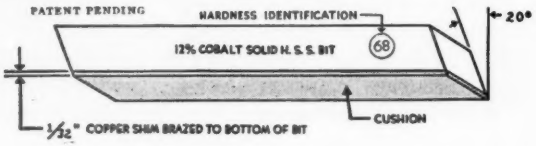
This and other models described in detail in new De-Sta-Co Clamp Catalog No. 45. Send for copy.

DETROIT STAMPING CO.

Established Over 30 Years

344 Midland Ave • Detroit 3, Mich.

Faster Cutting . . . on Toughest Jobs . . . with



12% COBALT HIGH SPEED CUSHIONED BITS

Can be used on the toughest jump cuts without chipping or breaking. Cuts difficult work faster than any other High Speed Steel bit, especially when shaping or planing tough alloys.

LOWER PRODUCTION COSTS

Actual shop runs, comparing cutting time of 12% Cobalt Cushioned Bits with 18-4-1 H.S.S. bits, resulted in a 70% saving in time on one job and 57% on another.

Machining costs can be reduced about 20% on work where H.S.S. is indicated. These bits pay for themselves.

OTHER FEATURES

Can be reground . . . The *Cushion* saves tool breakage . . . Cushion prevents damage to tool holder . . . Easier for operators to use . . . Each bit stamped with its Rockwell "C" hardness.

If you desire more detailed technical data drop us a line.
Sold through jobber distributors. Write for sizes and prices.

GENERAL TOOL & DIE CO.

555 Prospect St. **East Orange, N. J.**

Save production time with a SHOPLIFTER

- **Light, Compact**
- **Easily Moved About**
- **One-Man Operated**
- **Wide Range in Application**
- **Saves Production Time**
  in handling dies and heavy fixtures; stacking barrels, boxes, etc.; loading and unloading trucks

Specifications

Type—D
Capacity—500 lbs.
Overall height—72"
Platform lift—54" above floor level, lowers to within 5" of floor
Baseframe—24" wide x 33" long
Platform—24" x 24", steel plate
Entire frame of machine of structural steel, electrically arc welded throughout
Basewheels—4" diameter, iron wheels
Crank up and down hoist unit
Two swivel casters and two stationary wheels with push bar furnished
Painted olive green finish
Weight—250 lbs. (approx.)

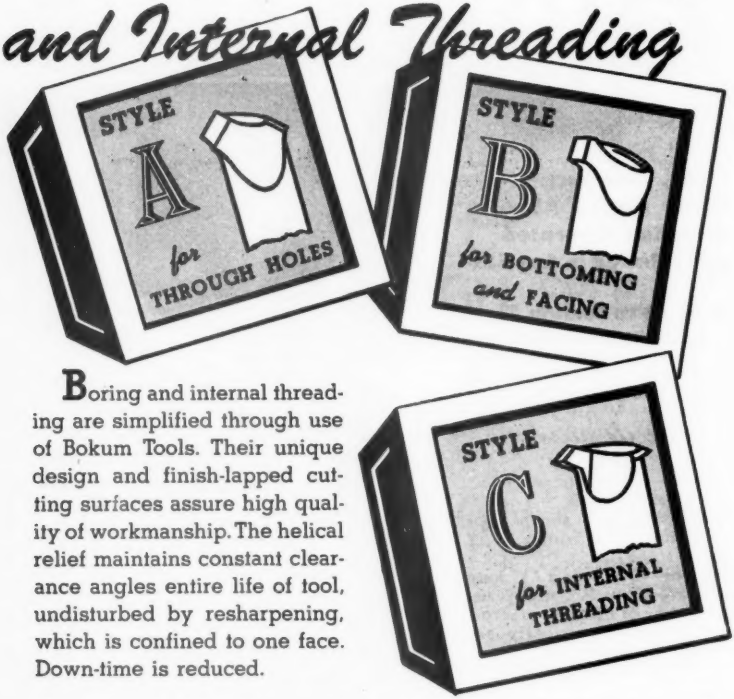
Heavier capacities up to 5,000 lbs. also available. Write for details.

Prompt Delivery . . . Price $157.50. Full freight allowed

Foot Operated Floor Lock—$10.00 extra

ECONOMY ENGINEERING CO., 2659 W. Van Buren St., Chicago 12, Illinois

The ABC of Boring and Internal Threading



Boring and internal threading are simplified through use of Bokum Tools. Their unique design and finish-lapped cutting surfaces assure high quality of workmanship. The helical relief maintains constant clearance angles entire life of tool, undisturbed by resharpening, which is confined to one face. Down-time is reduced.

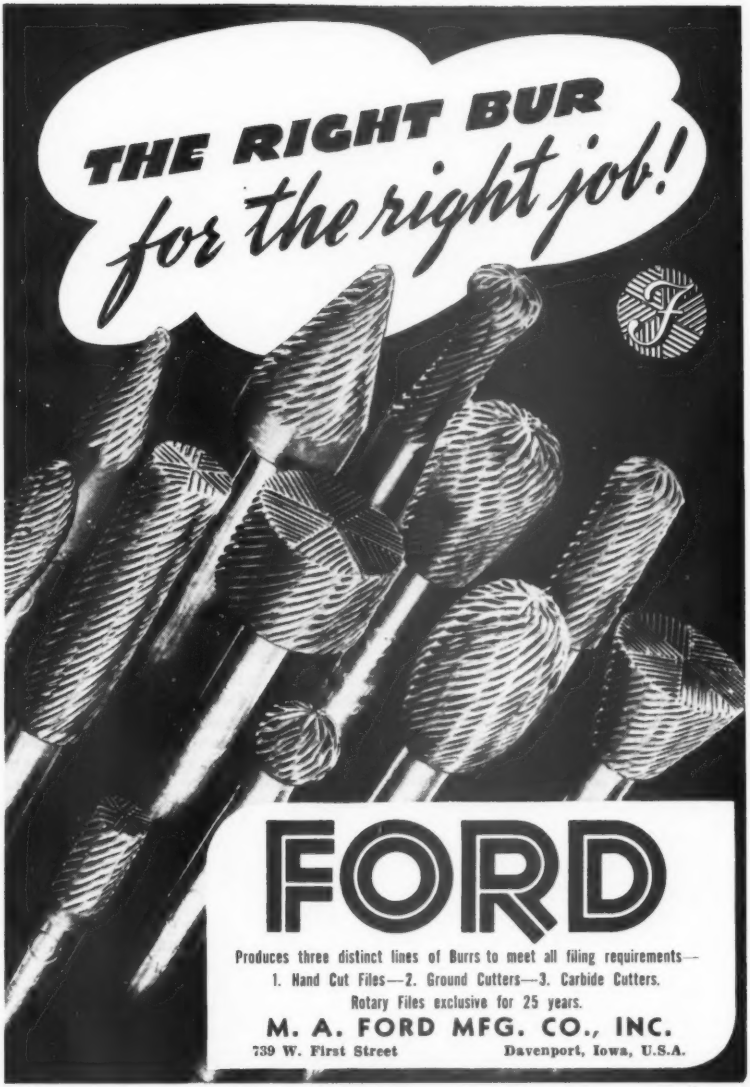
You're overlooking the opportunity for increased production and higher efficiency if you are not acquainted with Bokum Boring and Internal Threading Tools.

TRADE MARK REG. U. S. PAT. OFF.

BOKUM TOOL CO.

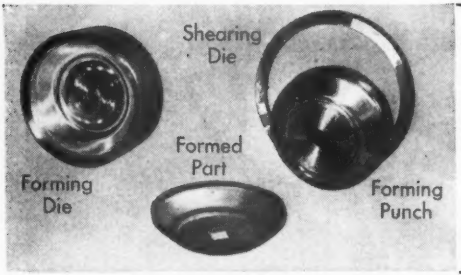
14775 WILDEMERE AVE. · DETROIT 21, MICH.

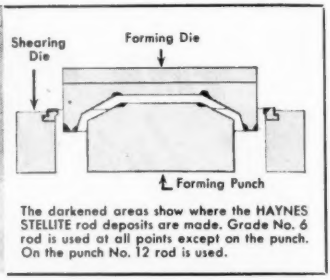
SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS


THE RIGHT BUR
for the right job!
FORD
Produces three distinct lines of Burrs to meet all filing requirements—
1. Hand Cut Files—2. Ground Cutters—3. Carbide Cutters.
Rotary Files exclusive for 25 years.
M. A. FORD MFG. CO., INC.
739 W. First Street
Davenport, Iowa, U.S.A.

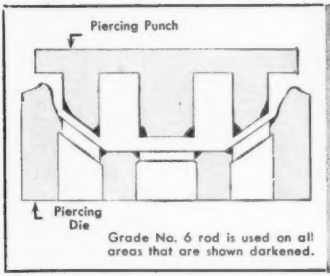
Hard-Facing saves $2,500 on these Truck Wheel Dies

. . . and they last 3 times as long

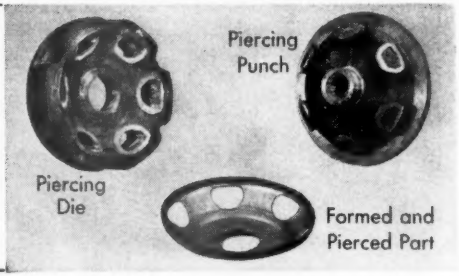




The darkened areas show where the HAYNES STELLITE rod deposits are made. Grade No. 6 rod is used at all points except on the punch. On the punch No. 12 rod is used.



Grade No. 6 rod is used on all areas that are shown darkened.



The old way cost $4,300. **Formerly these two sets of dies for making truck wheels were fabricated of special steels. They produced only 15,000 blanks.**

The new way costs $1,800. **By making these dies of carbon steels and hard-facing working surfaces with HAYNES STELLITE rods a saving of $2,500 is realized in initial costs. In addition, these hard-faced dies turn out 50,000 pieces.**

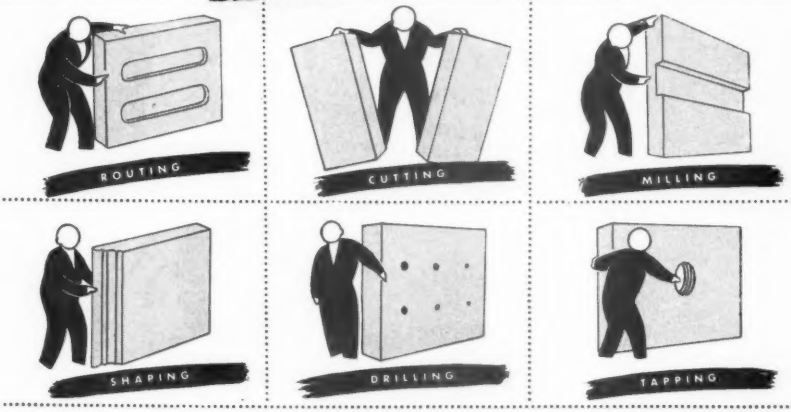
Hard-facing with HAYNES STELLITE rods is an economical way of increasing life in tools, dies, and many other metal parts subjected to extreme wear and abrasion. You can get more information about hard-facing and how to do it by writing for the booklet "Hard-Facing With HAYNES STELLITE Products."

HAYNES STELLITE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Chicago—Cleveland—Detroit—Houston—Los Angeles—
New York—San Francisco—Tulsa

HAYNES TRADE-MARK *alloys*

The registered trade-marks "Haynes" and "Stellite" distinguish products of Haynes Stellite Company.

All this... AND LOW COST, TOO!



with MASONITE *Die Stock!*

You can do a great many things to—and with—Masonite* Die Stock. The above operations are everyday occurrences to foremen and superintendents who have become acquainted with the amazing versatility of this lightweight semi-plastic material. They produce quantities of dies, jigs, fixtures and other tools—faster, and for less! Many novelties and other items are also being produced from Die Stock.

The ease with which Die Stock will submit to processing by high-speed equipment in metal or woodworking shop makes it a favorite wherever sheetmetals are fabricated—especially copper, brass and aluminum. Its aid to the aircraft industry during the war was beyond measure. Today, in addition to speeding preparations for straight production runs, it is used by many industries for experimental tooling, mock ups and experimental models.

Get all the facts about this dense, grainless material. Send in the coupon—now!

PRODUCTION PIN-UPS. Look for the next issue of "Production Pin-Ups" on your plant's bulletin board. Study the pictures and explanations of the latest uses of Masonite Die Stock.

*"Masonite" is a trade-mark registered in the U.S. Pat. Off., and signifies that Masonite Corporation is the source of the product.

MASONITE CORPORATION · 111 W. WASHINGTON ST. · CHICAGO 2, ILL.
Masonite BRAND DIE STOCK FOR TOOLING

Product of the State of Mississippi

MASONITE CORPORATION, Dept. TD-10, 111 West Washington St., Chicago 2, Ill.

Please send me illustrative literature and complete information about Masonite Die Stock.

Name .....

Firm and Title .....

Address .....

City ..... *Zone* ..... *State* .....

MILFORD PROFILE SAW

first choice for all contour sawing, jig and band saw machines

TOUGH AND FLEXIBLE

Made from electric furnace saw steel — side wear reduced to a minimum.

EDGE HARDENED — Teeth as hard as a hack saw blade.

MILLED TEETH — Uniformly sharp for fast cutting.

PRECISION SET — Will follow a straight or contour sawing line accurately.

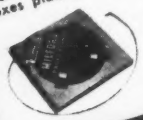
•

Backed by the "know-how" of saw specialists since 1876.

•

Order from your Mill Supply Distributor. He is always ready to serve your needs for all factory and mill supplies, as well as Milford hack saw and band saw blades.

The MILFORD PROFILE dispenser box was designed to insure maximum strength. The corners are supported by wooden blocks which prevents any crushing or binding. No binding wires are used. Simply run out, measure and cut desired length. Done in a jiffy. Saves hands and guards coil against corrosion. All boxes plainly labeled.



MILFORD

PROFILE AND BAND SAW BLADES

KEZISTOR AND DUPLEX HACK SAW BLADES

THE HENRY G. THOMPSON & SON CO.

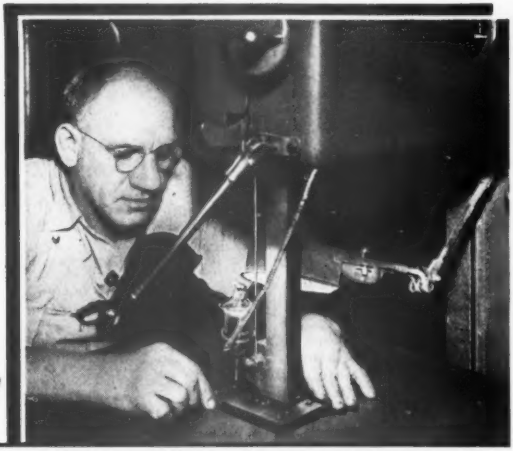
Saw Specialists Exclusively for Over 65 Years

NEW HAVEN 5, CONNECTICUT, U. S. A.

Specify ATLANTIC

BAND SAW BLADES

for Smoother

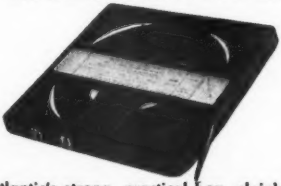


CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.



Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.

Atlantic Saw Mfg. Co.

INCORPORATED

Exclusively Manufacturers of Band Saw Blades

160 Brewery St., New Haven, Conn.

Now Ready THE NEW ENLARGED THIRD EDITION OF GORDON B. THAYER'S PLASTICS MOLDS

The Established Authority on The Design, Construction and Use of Plastics Molds

Now in its third edition, *Plastics Molds*, the widely known, widely used "original plastics mold book"—the established authority on the subject—is again available. Greatly augmented—272 pages—over twice as large as the second edition—*Plastics Molds* contains over 200 illustrations, including many workable drawings, tables and charts. Up to the minute, with latest techniques and "know-how", *Plastics Molds* is a thoroughly practical, usable book for the shop man, student or apprentice alike.

Completely Revised Twice the Text of 2nd Edition

There are new sections on "Estimating Plastics Molds", "Hard Chromium Plating for the Plastics Industry", "Plastic Tooling", "Materials for Plastics Molds" and an enlarged "Nomenclature of Plastics Molding". This last, much quoted section, is especially helpful to the student and apprentice.

Indexed in detail, with ample cross references and profusely illustrated, *Plastics Molds* is convenient and easy to use. Then too, its beautifully printed, attractively and substantially bound in cloth and more than twice its previous size. More than ever, *Plastics Molds* is "The Most Authoritative and Complete Book In Its Field".

Practical—Understandable

All text, tables and other material are revised to bring the book abreast of the fast moving developments in the industry. In greater detail than ever before, the new third edition completely discusses "Methods of Mold Sinking", "Finishing Methods and Equipment", procedure techniques of the rotary head method of milling mold cavities, the Gorton Duplicator, the Monarch Shapemaster and lead screw variating mechanisms, the Turchan duplicating attachment, and many more.

No other book concerned with the design, construction and use of plastics molds is so complete, so up-to-date, so authoritatively written, so completely workable and understandable as Gordon B. Thayer's Third Edition of *Plastics Molds*.

Hundreds of orders have been placed during past months when the 2nd edition was out of print. Now, the third edition of *Plastics Molds* is ready—your order today will assure you prompt delivery of your copy. Fill in and mail the order form below, at once.

Publication Price **$5.00** **Per Copy Postpaid**

Special discounts will be allowed on group orders of 10 or more copies from industry organizations.

Use the order blank below or your own purchase form

22 CHAPTERS—OVER 200 ILLUSTRATIONS

1. INTRODUCTION: DEFINITION, REQUIREMENTS, TYPES, FACTORS
2. SUGGESTIONS ON DESIGN PROCEDURE
3. PRACTICAL POINTS IN MOLD DESIGN AND CONSTRUCTION
4. MATERIALS FOR PLASTICS MOLDS
5. TYPES OF MOLDS FOR COMPRESSION MOLDING
6. THE DESIGN OF A SIMPLE COMPRESSION TYPE MOLD
7. THE DESIGN OF A SPLIT CAVITY COMPRESSION TYPE MOLD
8. THE DESIGN OF A SIDE-OPENING COMPRESSION MOLD
9. DESIGN OF A TRANSFER TYPE MOLD
10. THE DESIGN OF A SIMPLE INJECTION TYPE MOLD
11. THE DESIGN OF A STRIPPER-PLATE INJECTION MOLD
12. THE DESIGN OF A LOOSE-BAR INJECTION MOLD
13. AN INJECTION MOLD FOR A PLASTICS LENS—by Carl H. Whitlock
14. LOADING THE INJECTION MOLD
15. EJECTOR SYSTEMS FOR INJECTION MOLDS
16. MOLD BUILDING METHODS AND EQUIPMENT
17. METHODS OF MOLD SINKING
18. FINISHING METHODS AND EQUIPMENT
19. MOLDING SCREW THREADS IN PLASTICS
20. HARD CHROMIUM PLATING FOR THE PLASTICS INDUSTRY
21. PLASTICS TOOLING
22. ESTIMATING PLASTICS MOLDS

Tear off here

HUEBNER PUBLICATIONS · 2460 FAIRMOUNT BLVD. · CLEVELAND 6, OHIO

Gentlemen:

Please send me.....copy (ies) of Gordons B. Thayer's new third edition of PLASTICS MOLDS at $5.00 per copy, postpaid.

Remittance is enclosed ☐ Purchase order is enclosed ☐ Will be forwarded ☐

Name .....**Title** .....

Company .....

Address for mailing "Plastics Molds" .....

Everything for SURFACE GRINDING *from* DoALL

FORM DRESSER

ALL-PURPOSE GRINDING WHEELS

PRECISION SURFACE GRINDER

PRECISION SURFACE GRINDERS (HYDRAULIC) 2 MODELS

LONG LASTING, ALL-PURPOSE GRINDING WHEELS

LIFETIME PRECISION, ADJUSTABLE FORM DRESSERS AND DRESSING DIAMONDS

ELECTRO-MAGNETIC CHUCKS AND SELECTRON CONTROLS

COOLANT SYSTEMS FOR WET GRINDING

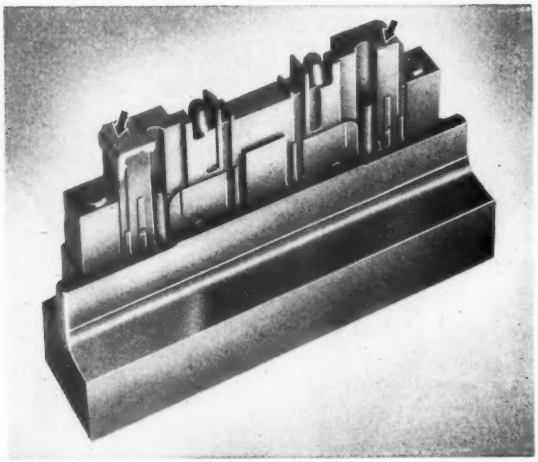
DUST COLLECTORS FOR DRY GRINDING

SOLUBLE CUTTING OILS

Whether it's a fine precision surface grinder or any of the accessories for surface grinders, all are available at DoALL. No need to get these from various individual sources when it's so easy to have a DoALL factory-trained engineer check your complete surface grinding requirements. ● It's a real revelation to see a DoALL Grinder at work—the last word in producing superfine surface finishes plus high precision in flatness, parallelism and size. ● DoALL Selectrons quickly demagnetize electro-magnetic chucks—permitting fast removal of work; no waste of time; no scratching of work. DoALL Coolant and Dust Collecting Systems for wet or dry grinding are designed for long, trouble-free service. Send for Surface Grinder circular today.

DoALL

Damaged punch saved by Welding



EUREKA electrodes make huge savings possible

The costly hot-work tool-steel punch illustrated above was reclaimed by repairing with Eureka Hot Work Tool Steel Welding Electrodes! Welding costs only a small fraction of the replacement cost of this unit which was back into operation with only a minimum delay. Eureka's complete line of Tool and Die Welding Electrodes will save many man hours, conserve material and minimize production delays.

Write for fully illustrated catalog

Welding Equipment & Supply Co.

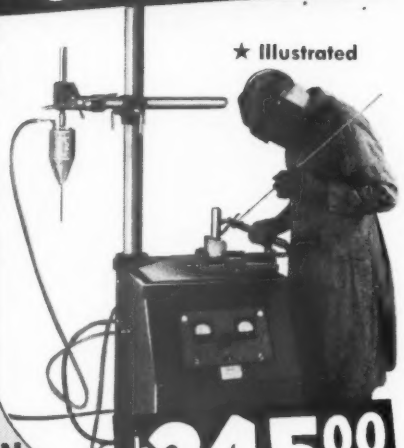
PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN

ONLY THE NEW Thomas GIVES YOU ALL 8 IN 1 MACHINE

Here's What The THOMAS Metal Master Will Do For You

1. DISINTEGRATION
2. ARC WELDING
3. SOLDERING
4. BRAZING ★
5. ETCHING
6. DRILL PULLING
7. DEMAGNETIZING
8. AIR EXTRACTION



★ Illustrated

$245.00
UP TO $895.00

NO TOOL SALVAGE ROOM IS COMPLETE WITHOUT A THOMAS

The famous THOMAS Metal Disintegrator that has saved so many thousands of dollars in tool salvage departments is now *more than just a disintegrator*. NOW, IT GIVES YOU 8 METAL WORKING OPERATIONS IN ONE MACHINE! . . . a complete salvage department in itself as well as an efficient production unit. Now, more than ever, you will find that a THOMAS will save money, time and materials for you . . . now, more than ever, a THOMAS is a necessity in your tool die rooms, salvage department, and on your production line. No other machine will do as much for you for so small an investment as a THOMAS.

MAKE RESERVATIONS NOW FOR A DEMONSTRATION

Clinton
MACHINE COMPANY
CLINTON, MICHIGAN

CLINTON MACHINE COMPANY, Clinton, Mich.
Sure! We want to see what THOMAS' 8 Metal Working Operations can do for us in our own plant ☐
Send literature ☐

Name_____

Address_____

City_____ State_____

Announcing

32 Alundum*

A Sensational New Abrasive

. . . The most important abrasive development in over 45 years—since NORTON introduced the original electric-furnace-made aluminum oxide abrasive (ALUNDUM*)!

32 ALUNDUM* is an entirely new type of electrically fused aluminum oxide abrasive.

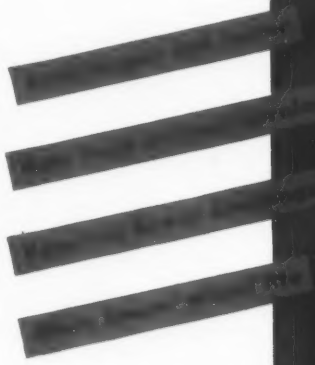
It's radically different in shape and in appearance.

It's made differently by a Norton invented and patented process.

Each super-cutting grain is a single crystal—individually produced in the electric furnace—not crushed to size.

It's the first and only abrasive with a sharp, nubbly surface for a super cutting action.

It's the only abrasive which combines a strong grain structure with a cool cutting action.



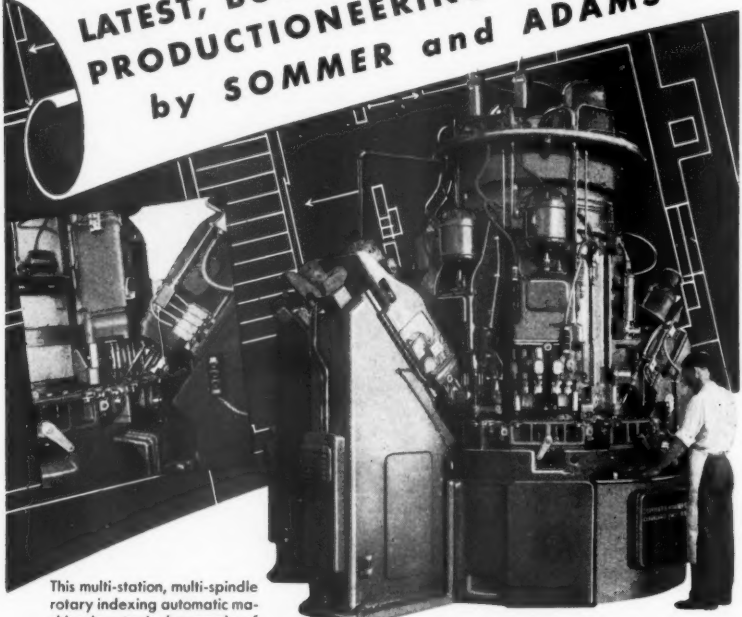
STOCK WHEELS AVAILABLE NOW FOR SURFACE, TOOL AND INTERNAL GRINDING — OTHER TYPES SOON

Write for additional information or, better still, call in your Norton abrasive engineer or Norton distributor.

NORTON COMPANY • WORCESTER 6, MASS.

Distributors in All Principal Cities

LATEST, BUT NOT LAST, PRODUCTIONEERING UNIT by SOMMER and ADAMS



This multi-station, multi-spindle rotary indexing automatic machine is a typical example of Sommer and Adams Productioneering. It is designed to bore, ream, counterbore, chamfer, tap and face a number of holes in small motor blocks, pump parts or machine components.

On the machine itself, any sequence of operations up to eight stations can be set up, each operating head having its own electric motor and hydraulic system, electronically synchronized with the rest, and with the indexing mechanism. These heads operate vertically. Further operations at desired angles may be added at any or all of the stations, with separate column-mounted heads having the same type of independent mechanism, which can be synchronized to the machine cycle. (Inset shows close-up of vertical and angle operations at the same station.) . . . Your problem may be different—but if it can be solved mechanically, Sommer and Adams can build machines to do it.

S&A

THE SOMMER AND ADAMS COMPANY

18525 EUCLID AVENUE • CLEVELAND, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES

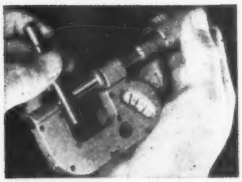
SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

EDITORIAL INDEX

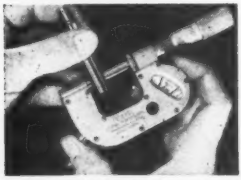
	Page
Editorial: Quality Control	77
Hydrodynamic "Fluid Punch"	78
Surface Finish Instrumentation by James A. Broadston	81
Air Power Control Of Machine And Work Feeds	87
Gaging By Optical Projection	90
The Flexibility Of Press Brake Tooling by A. H. Blacker	91
TDJ Shop Data Sheets	100
Accuracy Of Diamond Dressing Combined With Economies Of Crusher Roll Form Grinding	104
Industrial Digest	111
Progress-On-Parade	116
Publication Previews	131
Shop Aids	141
Inform-A-Gram	146A
Contract Tooling And Production	173
The Curb	175

THE MICROMETER YOU HAVE BEEN WAITING FOR

THE FEDERAL INDICATING MICROMETER



USED AS A MICROMETER — spindle is brought into contact until Indicator reads "O".



USED AS A GAGE — push button retracts anvil and dimension is checked on dial.

. . . Has Many Advantages Over Usual Type Micrometers

This new Federal Indicating Micrometer combines the precision of the Dial Indicator for uniformity of contact pressure and for use as a comparator, with the accuracy of the micrometer thread for measuring.

You do not need the skill of a toolmaker to operate it accurately. The Dial Indicator insures uniform contact pressure.

It takes the place of a complete set of "go and no-go" gages, because you can set it to the required size, clamp it in that position, and gage your batch of workpieces.

Anvil is retractable. Both contacts are Tungsten Carbide tipped.

It is light, easy to handle, and much easier to read.

Write for descriptive folder to —

FEDERAL PRODUCTS CORPORATION
1144 EDDY ST., PROVIDENCE 1, R. I.

Color Films Available No. 1 Dial Indicators. No. 2 Dial Indicator Gages. For instruction and training. Loaned on request.

FEDERAL MECHANICAL AIR and ELECTRONIC GAGES
PRECISION MEASURING INSTRUMENTS

quality control

In our contacts with those who are leaders in evolving successful ways and means of reducing the theories of Quality Control to work-a-day manufacturing processes, we have, at the same time, been exposed to certain unprogressives who have been inclined to speak disdainfully and with upturned nose.

They have (unsuccessfully) attempted to justify their stand by saying that Quality Control is simply a fancy pants, glamorized version of Inspection, which always has been with us and is an old story. And, furthermore, that trying to project the good old standby GO and NOT GO gage into the realm of the occult and that enveloping it with a sweet scented aura of statistical mumbo-jumbo is but gilding the lily; or, much, much worse, provides an opportunity for the professorial boys of the academic world to crash the gates of industry.

If one knew no more about Quality Control than the type of opposition it has met, that, alone, would be ample justification for diligent exploration of the field.

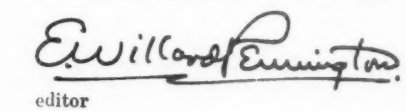
Tool & Die Journal prides itself in having its feet firmly on the ground and in being able to recognize progress where progress is being made.

We know that the use of statistical methods in the control of the quality of manufactured products has resulted in substantial savings in labor and materials (two increasingly expensive ingredients) in many establishments.

We know, too, that Quality Control and Inspection are mutually dependent, and that they may be shaped to fit each manufacturer's requirements. The nature of the product, the competition, the customer's needs, and the selling price of the product, are all guideposts toward the determination and installation of a Quality Control and Inspection program.

Spokesmen for some of the largest plants in the country advise us of their recognition, also, of the essentiality of Quality Control in such terms as: "* * * we are in the midst of our primary experiment with this system * * *", "* * * the methods are so new to us that our plans are changing almost daily", "We have had a fair amount of experience in applying Quality Control techniques to - - - manufacture * * *", "* * * we here, at the - - - are still in the embryonic stage * * *", "Here at - - -, we are in the process of formulating our plans for a Quality Control program", "The main interest of our division in this type of control is from the standpoint of acceptance inspection of raw materials", "* * * and have, at the present time, a fairly good example of Quality Control being used in the manufacture of production tools * * *".

As these and other plans and experiments jell, and through processes of elimination and the survival of the fittest are reduced to practical shop procedures, Tool & Die Journal readers are assured of being kept abreast of developments in Quality Control by authoritative articles "tailor-made" (by Quality Control of editorial matter) to their all-important field; i.e., that of producing the tools that produce the goods.



editor

HYDRODYNAMIC "*fluid punch*"

EDITOR'S NOTE: *Here in pictures, drawings and captions is condensed the story of a new method of working metal that is no less than revolutionary. It's another one of those "why didn't I think of that" propositions. As developed and patented by L. V. and S. A. Whistler of Buffalo, New York, the forming and embossing of shallow sweeps and shapes and the drawing of cores and tapered sections is accomplished in one operation and without use of a metal punch! Hardened aluminum alloys have been drawn into finished stampings without heat treating and re-striking. To date, stock up to 3/16" has been worked, wrinkle-free and without fracture, but the limit in material thickness that can be embossed or drawn by the Whistler Hydrodynamic process has not yet been determined. It has been proved by practical commercial usage and, as covered by United States and Canadian patents, is now being licensed for use by metal fabricators. E. W. P.*

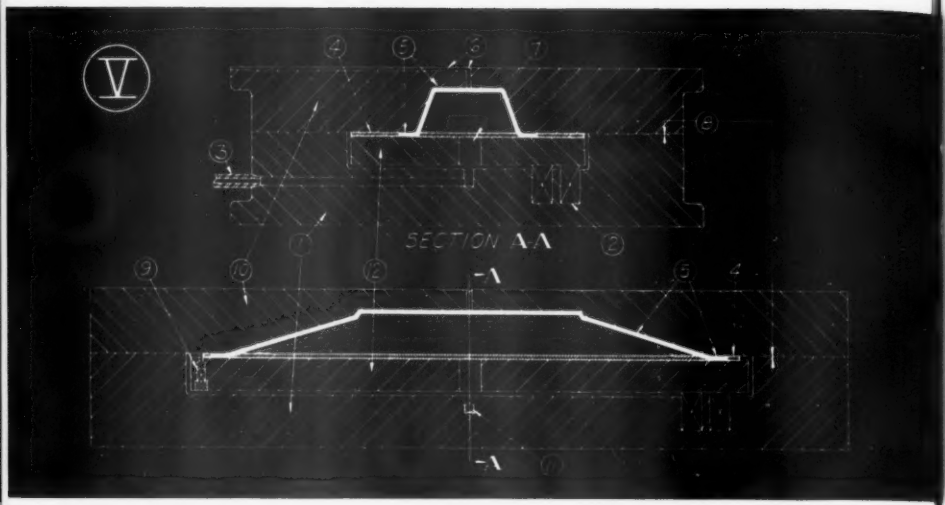
FIGURE I. The Hydrodynamic process is applicable to deep draws that involve gathering metal into the die as well as to shallow forming where the metal blank is held rigidly and only portions of its area are stretched, or Hydrodynamically punched, into conformation to the die cavities. Drawing I represents a hydraulic press job setup of the latter type. On the bed (3) is located an auxiliary bed (5) incorporating a high pressure water intake (4). The die (7) is secured to the crown (9) of the press. Additional details are the air vents (6), Meehanite wear plate (8) and the mechanical knock-out (10).

FIGURE II. The metal sheet to be embossed is placed on the auxiliary bed (5) and is raised into contact with the underside of the die (7) by means of the hydraulic cylinder and ram (1) and (2), and great pressure is built up sufficient to effect a water-tight seal between the successive contacting surfaces of the auxiliary bed (5), the work II, and the periphery of the underside of the die (7). Water under high pressure is introduced through the intake (4). As the water pressure is built up to several thousand psi, its only relief or flow is to stretch the metal and force it into the die cavities. The whole procedure is just as simple as its description. This particular job, illustration II, was made in production from .050" Armco enameling iron and .031" 18-8 stainless steel, both from the same die. As the work comes from the press, it can be laid on a flat surface without showing any appreciable twist or warp.

FIGURE III. The Hydrodynamic embossment of the flying horse symbol is approximately four feet wide and three feet high. Such work must have great eye appeal and is often finished in a high gloss enamel. Because of the large areas involved any blemishes due to faults in the process would be glaringly apparent, but the work comes from the Hydrodynamic die without wrinkles and with flat edges, showing that the metal has behaved as intended.

FIGURE IV. This relatively deep formed part of a heat exchanger is an example of the Hydrodynamic process applied to a job requiring that the metal be free to flow or be carried into the die cavity by the "fluid punch." The paradox of being able to do this and at the same time maintain the necessary water-tight seal when the press is closed is one of the outstanding innovations of the Whistler patents. In IV are shown the workpiece as it comes from the press, the die or upper member of the "Hydrodynamic pair," and the lower member or fluid container. The details of the tool construction and operation for this job are as follows:

FIGURE V. The fluid container (1) may be round, square or rectangular, whichever is best suited to the shape of the stamping. A pressure pad (12) is located in a recess in the fluid container and rests on a group of springs (2) which apply sufficient aggregate pressure against the material being worked to prevent it from wrinkling as it is drawn to shape. The blanked workpiece (4) is placed on the face of the pressure pad (12) and is properly located by spring pin gages (9). Closing the press brings together the surfaces of the die (10) and fluid container (1). This contact, metal to metal and without use of gaskets, is maintained under great hydraulic pressure and effects a water-tight seal (8)



between the outer areas of the die and fluid container. Note that now the press is closed and that, although the hydraulic ram is exerting great pressure against the meeting faces of the die and fluid container, the workpiece itself (4), resting on the pressure pad, is only subject to the compression (due to closing the press) of the group of springs under the pressure pad (12). Next, water at high pressure (regulated according to the material being worked) is injected through the line (3) and orifice (11) in the fluid container, and it fills the space surrounding the pressure pad and edges of the flat workpiece (4), fills the spring cavities (2) and flows to the underside of the work via the opening (7) in the pressure pad. Thus the water pressure or "fluid punch" is applied to the work over the greater areas first, but diminishing to smaller areas or diameters as the metal is drawn to the desired shape (5), free from twist or warp. The success of this type of Hydrodynamic drawing is due to the combination of three factors, i.e., the great, but independent press ram pressure creating the water seal (8); the restraining of the blank through mechanical pressure only by means of the pressure pad and its springs so that the metal can gather into the die; and finally and most important, the fact that the mechanical pressures, while not great enough to prevent the metal from flowing into the die, is nevertheless sufficient to prevent any seepage of water around the edge of the blank and between the work and die. The vent (6) provides for entrapped air. By conventional mechanical means, two to three operations would be necessary to produce this part.

FIGURE VI. To draw, by all mechanical means, this 21" x 6" cone, in one operation, would fracture the stamping due to the initial impact of the punch point. The job would be practically impossible with metal punches in less than three or four operations.

(CONTINUED ON PAGE 102)

Quality Control Tools:

Surface Finish Measurement Instrumentation*

Mr. Broadston's paper embodies the experiences and resultant premises of one who has, of necessity, made application of all the ramifications of surface quality control since its inception. He establishes the value of the end result, and surveys the several ways and means by which the reader can profit by today's techniques. We are confident that our readers, manufacturers of instrumentation, users and prospective users of these quality control tools, one and all, will find Mr. Broadston's timely and thought-provoking presentation of great practical value. Ed.

by James A. Broadston
Chief Engineer
Surface Checking Gage Co.
Armament Design Engineer,
North American Aviation, Inc.

My purpose is to bring you a message that will make you want to know more about the possibilities of using surface finish measurement in your own laboratories and manufacturing plants as a quality control tool. I am not an authority on surface finish measurement instrumentation but have merely had occasion to use and study it in my work. The real authorities are to be found among the technical and sales personnel of our leading surface finish measurement instrument makers who are always glad to tell you more about their instruments.

Before I become involved with the more technical aspects of this vital and important subject I must introduce two of my convictions.

My first conviction is that great opportunities now exist for the future improvement of surface finish measurement instrumentation since none of the existing instruments is completely satisfactory.

My second conviction is that even greater opportunities exist for those who increase the utilization of existing instruments in controlling the surface quality of products whose performance depends upon proper surface finish.

Surface quality control today lags far behind existing instrumentation primarily because there are so many men now in industry who do not realize that this instrumentation is no longer a laboratory curiosity but has grown up to the point where it can offer real and tangible help in all machine shops, instrument laboratories or wherever any machine work is done.

Many of you will probably say to

**A condensation of an address scheduled for the First National INSTRUMENTATION FOR TOMORROW Exhibit and Conference of The INSTRUMENT SOCIETY OF AMERICA, at Pittsburgh, Pa.*

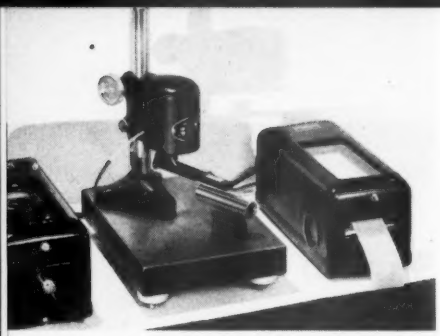


Fig. 1. Brush Development Company's Surface Analyzer set up for checking surface finish quality of wrist pin. At the left is the Calibrating Amplifier Unit. On the surface plate is the column carrying the Analyzer Head which is made up of the Drive Unit, Pickup Arm and Tracer Point. As the Tracer Point traverses the sample, the roughness of the path it encounters is permanently charted by the Direct Inking Oscillograph, the unit at the right.

yourselves that you only make a few special precision parts; that you do not have any real production to speak of; that all of your men are specialists and that you never have any trouble with surface finish anyway, so why bother. I am here to help you to realize that you are wrong. To help you realize that there is a place in your shop for a program of surface quality control whether your shop has but one lathe or consists of a whole factory full of them. Such a program will include not only proper instrumentation but also a practical system of machine finish designation for all drawings of machined parts.

What particular instrumentation you need will depend largely upon the type of work you do. I hope that in this brief paper I shall be able to give you some ideas that will assist you in making the proper selection.

Those convictions of mine offer a challenge to both the users of such instrumentation as well as to the designers of such instrumentation. They constitute a double challenge to all who are willing to take an interest in the future.

As Mr. Kettering has so aptly said: "I am interested in the future because I am going to spend the rest of my life there."

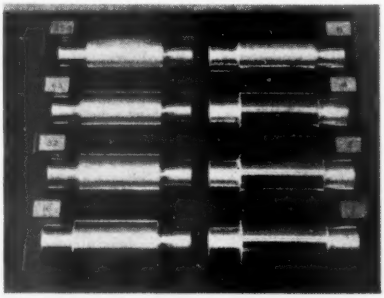
Unless we make an effort today to improve the conditions of the past the future will not be any better. It is what we do today, tomorrow and the next day that counts.

Let's go back into the past a few years and build a perspective view of the manufacturing industry's habit of progress so that we can see how surface finish instrumentation and its proper utilization fit into the scheme of things.

There are many men now in industry who can remember the days when every first-class machinist was his own inspector and assembler. Those were days before mass production and interchangeable manufacture. The machinist could do the whole job from the roughly pencilled sketch to the finished machine. At that time he had probably never heard of "tolerances" but he knew how to make shrink fits, drive fits, sliding fits and running fits. He knew which parts had to fit together and which were the mating surfaces of each. He took special care to make his journals and shafts smooth. He was an accomplished craftsman who had spent many years both as an apprentice and as a journeyman machinist in learning his trade. He naturally took pride in his work. He knew his success or failure on the job was dependent upon how well his machines worked. Their quality was judged by their performance and appearance.

In some industries, where mass production and interchangeable manufacture have made it necessary, dimensional limits have had to be imposed so that mating parts could be assembled easily and accurately and so that spare parts

Fig. 2. A set of cylindrical surface finish specimens, produced by the Norton Company, to serve as standards for ground surfaces.



that would fit could be supplied to distant customers. Now there are literally thousands of different types of instruments and gages for controlling the dimensional tolerances of these parts as well as the composition and physical properties of the materials from which they are fabricated.

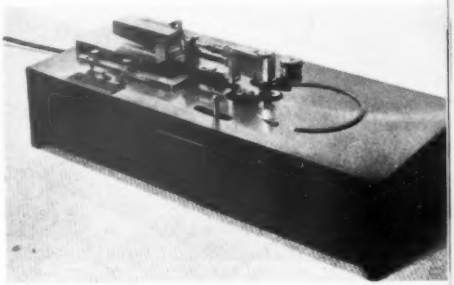
One of the chief reasons that many men still consider surface finish measurement in the class of laboratory technical hocus-pocus is because most of the articles on the subject have been written by research men who were searching for better ways to measure surface finish. They have dealt primarily with the technical details of investigations they have made. Most of these hold little interest to the practical man. I have yet to find a worthwhile article that truly reflects the practical man's viewpoint so that others with similar ideas and problems will see the value of a properly planned program of surface quality control.

Usually these engineers or technicians have described instrumentation that at the outset appeared beyond the reach or need of the practical man's shop. These practical men would ask themselves, "Will it pay its way?" To most of them the answer was always, "No!"

In many cases the answer was correct, not because the instrumentation was at fault, but largely because there was no one in the organization who had had the experience necessary to use the instrumentation to full advantage and thereby make it a paying proposition. I know of several large nationally known manufacturers who have invested thousands of dollars in instrumentation which is now peacefully reposing in their laboratories collecting dust because no one in their organization has the vision to bring it out and use it to advantage. Education in this new science of surface quality control is most important.

First we must find out why surface quality is important. A few months ago I had the pleasure of receiving a letter from Mr. R. E. W. Harrison, now Vice President of the Chambersburg Engineering Company. I was associated with him almost twenty years ago while he was Chief Engineer of Cincinnati Grinders, Inc. Mr. Harrison was a real

Fig. 3. A piston ring inspection fixture developed by the Physicists Research Company, manufacturers of the Profilometer. The rings are power-piloted under the pickup stylus and may be measured by tracing circumferentially, radially or by a combined action.



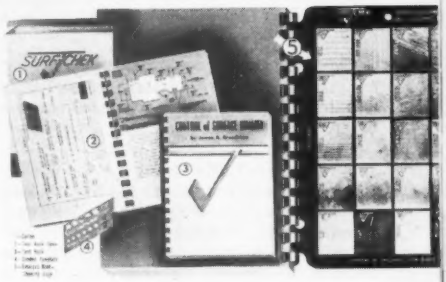


Fig. 4. A set of twenty replicas of turned, ground, milled, honed, lapped and polished surfaces varying in roughness from 500 to 5 micro-inches. Put up as a kit by the Surface Checking Gage Company, there is also included Mr. Broadston's text, "Control of Surface Quality," and a draftsman's template for surface designation symbols.

pioneer and I believe he was the first to set up a series of samples of ground finishes for direct comparison with parts in process. They were used as standard check pieces by both our own shops and those of the Cincinnati Milling Machine Company.

We had been discussing surface quality control and its importance to industry. In his letter Mr. Harrison said:

"A whole textbook could be written on

Fig. 6. "Packaged" surface finishes as developed by the University Machine Company. The twenty-three specimens have a roughness range of from two millionths to 500 millionths of an inch (rms). The blocks are of stainless steel and are representative of all ordinary machine tool operations such as shaping, milling, turning, grinding and polishing. Each sample is engraved to identify surface type and micro-inch reading.

the history of the endeavor to set up Surface Quality standards, but despite all the setbacks and oppositions, the fact remains that Surface Quality Control is even more important than rust prevention, inasmuch as improper control of quality wears out more machinery than any other single factor."

Mr. Harrison concluded his letter with this paragraph:

"Probably the one fact which accounts for the ability of the modern motor car to run one hundred thousand miles with the same engine is the circumstance that better finishes under proper control are now applied to all wearing or loaded surfaces".

It is obvious that were it not for surface finish measurement instrumentation such "proper control" would be impossible. As a result the automobile industry has been one of the leaders in making such instrumentation pay its way, particularly where very finely finished surfaces are used.

My limited contacts with the automotive industry lead me to believe that their products could be improved even more by a further use of surface quality control and designation. At the same time they could reduce their costs by many hundreds of thousands of dollars per year by merely extending control to rougher surfaces and not doing any machine work finer than necessary.

It has been said (and to a large extent it is true) that the quality of the surface finish may have a far greater influence upon the life and proper functioning of a part than either its composition, strength or dimensions. Since adequate controls are set up for these latter properties is it not reasonable to believe that the proper control of the surface finish would be even more worthwhile?

Before anyone gets the wrong idea let me say that I am not contending that super-smooth surfaces should be used everywhere. This is decidedly not the case. From an economic standpoint rough surfaces cost less than smooth ones.

It is seldom good economy to make a surface smoother than it really needs to be, unless it can be finished at the same time another adjacent surface is finished or unless the only means of sizing will actually produce a smooth surface.

Fig. 5. The Comtor Quick Scanning Surface Comparator is of the reflectivity or gloss meter type. It incorporates a light source and a photoelectric cell, whereby measurement is made of the light that is reflected from the workpiece surface, in comparison with a master sample or accepted standard.

The adoption of a proper drawing notation which will point out those surfaces of a part which need special care and a fine finish and those which can be allowed to remain rough will reduce costs by preventing misapplication of effort.

For example, suppose we consider a very simple part such as the piston and rod assembly of an hydraulic strut.

If the old-time machinist were asked to make it he would undoubtedly finish it smooth all over. He would take pride in its appearance and he would not consider a rough surface or a chatter mark acceptable shop practice. He might spend an hour turning and polishing the flat piston faces and an equal time on the rod itself.

If we are to reduce costs and improve quality through the adoption of surface quality controls we must determine which surfaces are critical and which are not. The designer is best able to determine these facts at the time the drawing is made. In our example the rod itself must slide through a packing gland and must therefore be smooth. The outside diameter of the piston must also be smooth since it slides within the hydraulic cylinder, but it need not be as smooth as the rod since it is always well lubricated and slides against a smooth metal cylinder bore. The rod, however, must slide against a soft packing and may be dry and dusty when retracted.

The only other surfaces of importance are the packing ring groove in the piston head and the mating surfaces that attach to the machine driven by the strut.

The two flat faces of the piston, therefore, can be as rough as normal rapid machining processes will leave them since they only contact the hydraulic fluid or stop against the strut ends at full stroke.

It would, therefore, be advisable to inform the machinist and inspector of these facts by designating the required surface quality for each surface of the part on the drawing.

Such roughness numbers indicate the maximum allowable average surface roughness in micro-inches as indicated by either an instrument or by fingernail comparison with standard roughness blocks having known roughness values.

From these notations the machinist will know at once that the piston rod must be very smooth, the ring groove not quite as smooth, the piston side just smooth, but the flat ends of the piston can be rough. He will therefore put the time into the surfaces that need special care and let the rest go. Of course they must still be held to proper dimensional tolerances. His boss will not question his work when the drawing clearly indicates that some surfaces can be rough. Even on one simple part, time and effort can be saved and the part is better for the use of a roughness designating system and better control.

There are many parts far more complicated than a piston rod where it would be almost impossible for anyone but the designer to know which surfaces are critical and which are not. If the designer designates the required finish for the critical surfaces and gives a generous overall roughness allowable for the non-critical ones, savings will accrue all along the line, or for equal cost more perfect critical surfaces can be prepared which will improve product quality and life.

There are many other reasons why surface finish control is important but they can only be mentioned in this brief paper so you will have to use your imagination. Among the qualities that are affected by changes in surface roughness we might include:

1. Life; how long will it last? Remember friction, abrasion, wear, lubrication, bearing area, corrosion and galling.

2. Safety; how strong is it? Remember stress concentrations, fatigue strength, notch sensitivity and imposed loads.

3. Function; will it work properly? Must it slide freely, fit properly, prevent leakage, serve as a bearing, as a mating part or rub over packings without damaging them?

4. Appearance; does it look good? How about adhesion of plating or other protective coatings such as paint? (Are good looks important?)

5. Heat transmission; rough surfaces are good radiators and heat absorbers,

smooth surfaces serve better as insulators.

6. Are optical properties important? Mirrors, and lenses; transmission, reflection or refraction of light or heat.

Even those who do not make machines or parts to sell often manufacture special processing machinery for use in their own plants. Surface Quality Control is just as important to them as it is to others. A list of users would include almost every conceivable industry from cosmetics through breakfast foods and railroads to aircraft and paper mills.

Surface finish measurement instrumentation should be considered to include not only commercially available instruments such as tracer point analyzers, optical comparators, reflectivity or gloss meters and sample roughness blocks, either originals or replicas, but also all other devices for the purpose that have been used experimentally.

It may seem paradoxical that in one breath I say that great opportunities exist for the improvement of surface finish measurement instrumentation itself and in the next I urge that all should make greater use of such instrumentation.

A good thing may not necessarily be perfect. In fact, very few things made by man are perfect. I hope to make it clear that existing instrumentation, though admittedly far from perfect or ideal, is nevertheless very useful and is not being used as extensively by industry as it should.

I will not attempt to go into the details of operation of the various types of surface finish measuring devices, even though that was part of my original intention. Much has already been written and published that discusses these devices thoroughly. Those of you who are interested in the practical side of the problem do not care anyway as long as they give you a satisfactory index to the surface quality without destroying the parts.

For those of you who are the technicians, electronic experts, instrument designers and others who are interested in accepting my challenge for the improvement of surface finish measurement instrumentation, I am including a few remarks that will help you to become familiar with some of the problems involved.

When we take a small magnifier we find almost everything we own has a characteristic surface texture. Consider as examples pieces of paper, leather, canvas, cloth, wood, linoleum, wallboard. Each is different from the other. Even by the eye alone it is easy to distinguish between the machine finishes produced by milling, turning, lapping, honing, grinding, etc., as each process leaves a different characteristic surface roughness.

When we consider that there are not only so many different types of surfaces, but also many degrees of roughness for each, it is not surprising that no one has yet found a surface finish measuring instrument that can begin to do the whole job. We should not, therefore, be too critical of existing instrumentation.

Many industry men and many technical groups have studied the problem without startling results. It still holds a challenge for the instrumentation industry to do better. Existing instruments of a type often do not give the same reading on a given specimen, but our practical man doesn't necessarily demand that.

Tracer point analyzers have contributed more to the advancement of surface quality control than any other single factor. With all their precision as instruments, however, a recent unbiased study conducted by the National Bureau of Standards and the Army Ordnance Department showed that their readings are not always consistent or dependable over a wide range of surfaces.

The fact that the tracer point itself induces certain errors due to its inability to precisely follow all of the surface irregularities, plus inherent differences in the response characteristics of the pickups, amplifiers and meters involved, makes duplication of results quite difficult. It is this difficulty in attaining duplicate readings that is delaying national standardization of surface roughness for machined parts.

Another consideration is that no generally acceptable criteria have ever been

(CONTINUED ON PAGE 106)

Air-Power Control

Of Machine And Work Feeds

The flexibility of application of the Bellows Air-Motor is attributable to its design, wherein the unique control features are incorporated in the head of

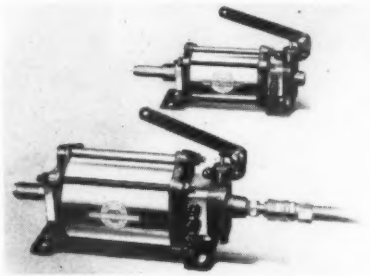


Fig. 1. Bellows Air-Motors are small, compact, air-driven, double acting, reciprocating power units.

the motor as shown in Figure 1, above. The operating lever is easily adjustable to operate from "any angle in any plane." The speed of the piston rod advance and retraction is independently controlled by two throttle valves, and is subject to wide variation. The valve operating lever permits easy connection to, and ready synchronization with, any reciprocating machine movement, either by direct linkage, by cam, or by a solenoid, actuated by a micro-switch, cam or electron tube. Thus one air-motor can be used to open and close a vise or holding fixture and timed to function automatically with the movement of a second air-motor feeding the work or tool.

The very large number of different applications of this air-motor is credited to the ingenuity of users in war plants, where, under the stress of heavy production programs, more work had to be performed with fewer workers.

Some of these applications are given here. The reader may get profitable ideas from them. Figure 2 shows a setup in which two pins are pushed into a shell fuse to uniform depth. By the arbor press method 350 pieces per hour had been assembled. This was increased to 1200 per hour by a Bellows Air-Motor.

Figure 3 shows three air-motors installed on a window frame gluing and clamping table, one on the short end and two on the long side. A girl operator increased her production of frames from 65 to 400 a week.

In an operation of cutting extruded aluminum strips on a cut-off saw into pieces 3" x ⅞" x ½", Figure 4, three air-

Fig. 2. Air-motor setup pushes two pins into a shell fuse to a uniform depth.

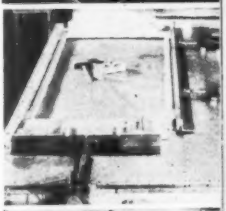


Fig. 3. Three air-motors utilized on a window frame clamping operation.

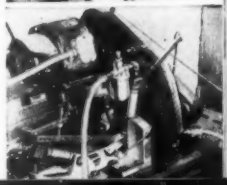


Fig. 4. Three air-motors installed on a power cut-off saw.

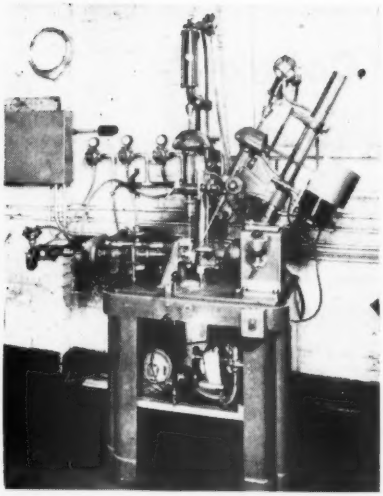


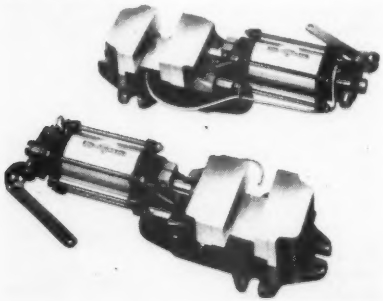
Fig. 5. Three Atlas drill heads with air-motors operating the feeds.

motors were installed on the saw, one to lower and raise the saw for the cut, a second to feed the strip in for the cut, and the third to actuate the clamping fixture. The three motors were synchronized so that as the saw finished a cut and was being lifted, the clamping motor opened the holding fixture and the feed motor pushed the stock up for the next cut. Next, the clamping motor closed the holding fixture and the first motor lowered the saw for the next cut. Production was increased from 270 cuts per hour to over 1000 per hour and saw breakage was decreased from an average of four to five a shift to one a day.

A special machine, using three Atlas drill heads with Bellows Air-Motors operating the feeds, is shown in Figure 5. Forged brass, oxygen and acetylene regulator bodies have three holes drilled simultaneously. With the addition of the Air-Motors, production was increased from 100-120 to 210 pieces per hour.

An air-vise, developed by the Bellows Co., utilizes the air-motor for its power. The exhaust air, conducted by copper tubing from one of the dual exhaust valves to the vise jaws, blows the chips from the vise when used on machining operations, or can be used to expel workpieces from the vise, as can be readily seen in Figure 6.

Fig. 6. Bellows Air-Vise with exhaust air piped to jaws for cleaning out chips or ejection of workpieces.



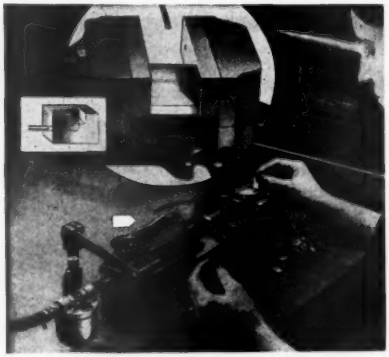


Fig. 7. Air-Vise assembly setup, adjusted to eject parts and sort according to weight.

One manufacturer was clever enough to make the exhaust pressure on his air-vise serve as a sorting aid. An assembly operation was being performed with an air-vise from which the part could be expelled by the exhaust air. The final weight of the assembly could not exceed a specified amount. By adjusting the exhaust pressure to the proper amount, those pieces of the correct weight were tossed into a box at a certain distance from the vise; those which were overweight would not travel as far as the

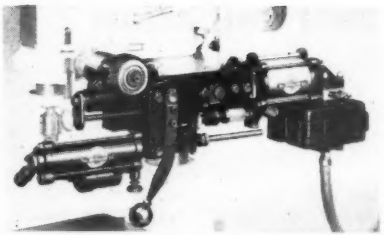


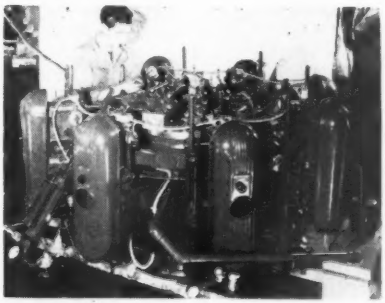
Fig. 8. Bellows-Senacon Drill Press Feed.

lighter ones, therefore dropped into a box placed nearer the vise, thus sorting the parts according to weight, Figure 7.

The Bellows-Senacon Drill Press Feed, Figure 8, utilizes the air-motor to actuate a rack and pinion gear mechanism. The pinion gear is pinned to the star wheel shaft of the drill press, thereby establishing a driving connection from the air-motor through to the rack to the drill press feed. Feeding pressure is equivalent to approximately five times the airline pressure. An airline pressure regulator insures the desired feeding pressure. The rate of feed of the drill press spindle in either or both directions is controlled by adjustable valves.

The Bellows-Senacon Hydro Check is optional equipment for certain types of operations. It is an adjustable hydraulic resistance unit providing checking in the forward direction only. It may be used to "check" the feed at point of break-through or during entire operation.

Fig. 9. Special horizontal drilling machine setup with seven standard drill heads equipped with feed mechanism.



Drilling, tapping, milling, reaming, threading, and hollow milling are other operations incorporating this equipment as the feeding mechanism. The adaptation of it to many unusual setups is again credited to the ingenuity of users. In the following illustrations, Figure 9 shows a special purpose machine embodying seven standard drill press heads, set horizontally on a rotary table, which automatically perform drilling, reaming, tapping, and counterboring operations.

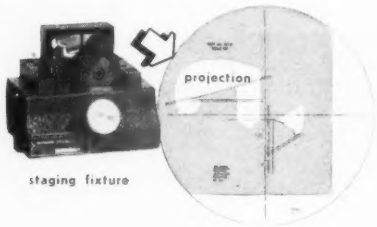
Fig. 10. Drilling plastics parts using the Hydro Check on the drill press feed to control the break-through.

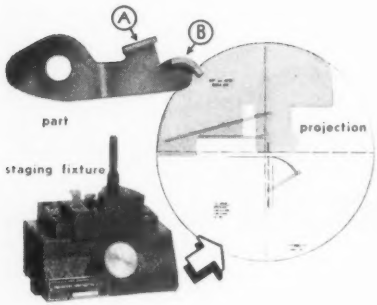
Drilling of plastics parts is sometimes difficult because of damage occurring on the break-through. Figure 10 pictures an operation where production rate was not increased, but due to the Hydro Check, rejects caused by break-through damage were reduced so that the number of parts which passed final inspection was greatly increased.

Detailed information and specifications on these air-power tools will be sent on request from THE BELLOWS-SENACON CO., Dept. 8-39, 789 N. Main St., Akron 10, Ohio, or use INFORM-A-GRAM Key No. 839-Q.

Gaging By Optical Projection

By projecting an accurately magnified shadow, the Optical Projection Comparator provides the means for seeing and measuring "split thousandths." When scientifically co-ordinated Staging Fixtures and Chart-Gages are used with it,





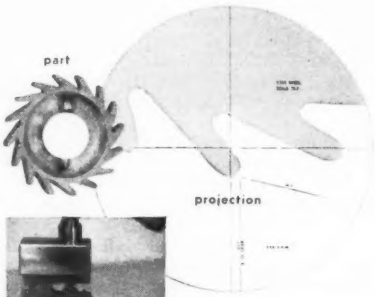
it forms the basis for more rapid and accurate inspection and for fuller utilization of other applications of optical projection in maintaining control of both tooling and production. Application of this method of dimension control embraces products as diversified as pins and propellers . . . taps and turbines.

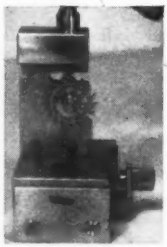
The solution to a metal stamping problem is shown above. Specification of the stamping shown required close limits on "flats" A and B. That both radii and angles were involved indicated projection inspection. The co-ordinated Staging Fixture and Chart-Gage make possible a rapid visual inspection at a rate in excess of 500 per hour.

Production tolerances are measured and maintained on a star wheel in the bottom illustration. Staging fixture with "wedge" plunger locates teeth on positive stop, allowing rotation of wheel so that each tooth may be checked rapidly against spacing of leading and following tooth. Co-ordinated Chart-Gage at 25X positions the outline of three teeth accurately for projection comparison.

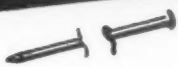
A pinion and integral shaft required high accuracy in production and mechanical gaging appeared complex and slow. Projection inspection using the Staging Fixture and co-ordinated Chart-Gage completed inspection of 18 critical dimensions by five positions in 15 seconds. The least tolerance was .0005" and the greatest was ±.002; magnification 50 times. Screw threads, form tools, and hobs also utilize this method.

Write Engineers Specialties Division,





Dept. 74, The Universal Engraving & Colorplate Company, Inc., 980 Elliott St., Buffalo 8, N. Y., for details, or use INFORM-A-GRAM Key No. 74-Q.



The Flexibility Of Press Brake Tooling

by A. H. Blacker
Methods Engineer
Cleveland, Ohio

Many manufacturers who fabricate from sheet and plate metals have, during their wartime experiences, become familiar with the great variety of operations which can economically be performed on the press brake. Yet, both these manufacturers and others whose experience with this tool has been relatively limited have not taken full advantage of its inherent possibilities. It is true that many of the operations performed on the press brake have resulted from war born experimentation, but their success has been so complete, from the point of view of both performance and economy, that these applications should now be considered standard methods.

One trend, which can be attributed to the present day shortage of press tools, is the frequently encountered redesign of products to incorporate a forming operation on the press brake which can replace an original design calling for a deep draw. Where such a redesign is practical, other advantages such as a minimum expenditure for dies, and a considerable saving in time of preparation will result. The great accommodation in length and depth dimensions available with the press brake also makes such a design practical as the die problem is not magnified by these considerations to such a great degree. Correct design can very frequently incorporate the use of standard punching, notching, and forming equipment so that tool maintenance and tool changes can be held to a very minimum of expense.

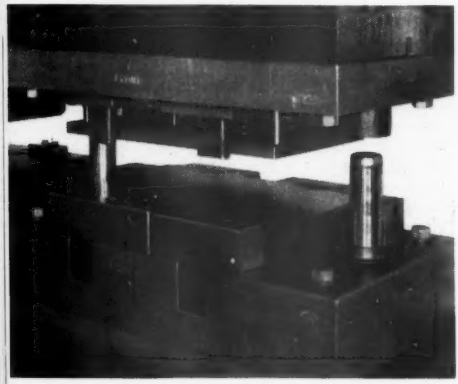
The press brake, which was limited twenty years ago to the applications of a sheet metal shop, has been strengthened, refined, and enlarged to such an extent that it has become applicable to much heavier and more intricate fabrication. A glance through one manufacturer's catalog shows tooling for the following processes: forming of channel, bead, tube, track and partition posts; taper and cone forming; multiple punching, trimming and notching; embossing; corrugating and curving; notching and forming; and straightening. It should be noted that the design of this type of tooling lends itself readily to applications of the above operations on work of great overall length, and also allows combinations of these operations to be performed simultaneously or in sequence on the same machine.

A typical example, Figure 1, of serial operation is seen in the fabrication of telephone boxes of ball corner construction. The first operation is to notch the previously blanked piece, the second to emboss the face and turn up the side flanges. Three more steps turn up the top and bottom faces, form the ball corners and complete the protrusions for welding on the sidewalls. The five dies required are installed on the bed of a single machine and can be loaded by one or more operators, yielding a considerable saving in conveying, handling, and floor space. These savings are of considerable importance, not only from the standpoint of costs, but also in the light of the present shortage of skilled man-

Fig. 1. Press Brake tooling for telephone boxes of ball corner construction. Note display of workpieces showing, from right to left, the sequence of operations performed on the original blank. Courtesy, The Cyril Bath Company.

power. In a series of operations of this nature the parts are returned to the conveyor only after the final one is completed and the parts are ready for removal to those departments where further work is required. The appreciable saving in floor space is effected because carriers are not needed for the intermediate steps.

Fig. 1-A. Close-up of first station operation of Fig. 1 which notches the blank prior to embossing. Courtesy, The Cyril Bath Company.



As has been pointed out by Mr. A. G. Baumgartner of the Cincinnati Shaper Company, the press brake today can be looked upon as a small factory by itself. Another example of a multiplicity of operations that may be handled in one pass across the machine is depicted in Figure 2. Here is shown a single press brake "production line" tooled up to perform four notching and bending operations on a workpiece destined to become a water cooler shelf. Work of this size and shape lends itself so obviously to fast handling as to particularly emphasize the economies effected by elimination of intermediate stacking, stacking floor space, as well as extra machines. Figure 3 illustrates a four-man, one press brake production line, and Figure 3-A depicts a combination of one man, one press brake and three simultaneously flanged workpieces.

Another interesting application is the use of the brake for embossing and

stamping. It has been proved economical for blanking and embossing automobile license plates, railroad crossing markers, Figure 4, and road signs. With the use of wide bolster plates attached to the machine bed, pieces up to two feet in diameter have been stamped and embossed. Corrugations in large sizes can be held to practical tolerances and some machines are equipped with an automatic feed so that corrugations can be economically produced, and, if required, matching holes can be punched simultaneously. Moreover, corrugated sections can be curved accurately to large radii, forming sections of four foot diameter and greater. Where corrugations are hand fed, a die which incorporates a pilot to index on the previously formed radius, Figure 4-A, is advisable to maintain regularity and save operating time.

Figure 5 shows the three basic types of dies used for radius bending. The most commonly used is No. 1, in which the radius of the male die section is formed slightly smaller than the radius required. The female die requires an included angle of less than 90°, these differences being determined by actual trial with the metal to be formed. This type of die can be used to advantage where the springback of the metal is great. Where the metal used tends to bulge from the male die due to its thickness or rigidity, type No. 2 is used in which the true radius can be formed by bottoming. Care should be used to avoid straining the machine with this type of die, and the setup should be made with this in mind. In light metals, this cannot be done and the best method for preventing bulging is by providing a spring pad, Figure 6, in the female or vee die which will force the metal against the male. Type No. 3 is used for very large radii, formed by feeding the metal in a series of short steps, the radius be-

Fig. 2. Another single Press Brake production line of four notching and bending operations, from blanked workpiece to water cooler shelf. Courtesy, The Cincinnati Shaper Company.

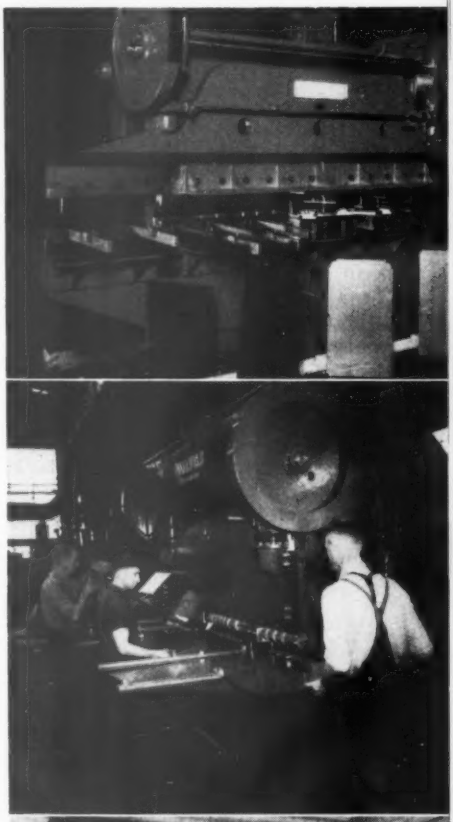
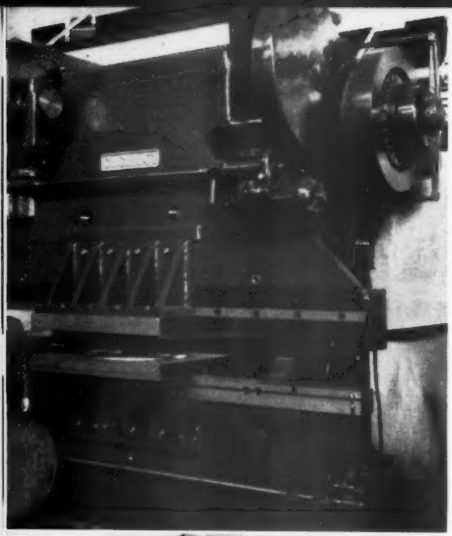


Fig. 3. A four-man, one Press Brake, production line. No floor space is sacrificed to stacking or bulk handling between operations. Courtesy, The Cleveland Crane & Engineering Company.

Fig. 3-A. Neatly rounded flanges can be formed on several panels at every stroke of the ram, accurately and speedily. Courtesy, The Cleveland Crane & Engineering Company.



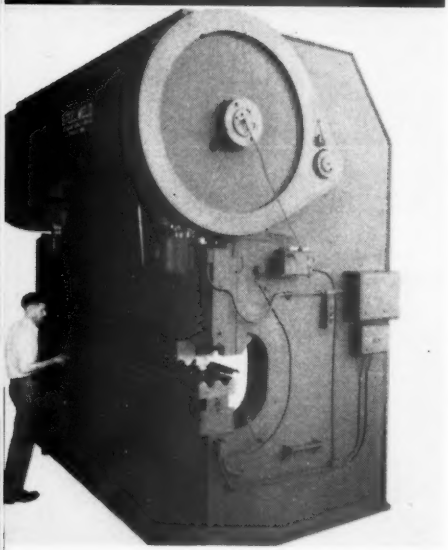


Fig. 4. The utilization of upper and lower bolster plates permits the embossing of this RR X-ing sign. Note four gage pins on periphery of lower die for locating workpiece. Courtesy, The Cincinnati Shaper Company.

Fig. 4-A. Greatest accuracy when corrugating by hand feed is attained by incorporating a spring-relieved pilot punch to index on the previously formed radius. Courtesy, The Cleveland Crane & Engineering Company.

ing determined by adjusting the stroke. Where the contour requires a smooth surface, the radius of the male die should be as great as is practical, since a sharp die may form a series of ridges.

Two production applications of this latter type of tool, Figure 5, No. 3, are shown in Figure 7, a straight cylindrical section form, and Figure 8 demonstrating the forming of a conical section.

Figure 9 shows several typical multiple operations; illustrations No. 1 and No. 2 are of consecutive operations performed on the same die, while the others can be arranged to operate in sequence on the same machine. Note that a cam action is used in the second operation of illustration No. 3, and the use of a mandrel is shown in No. 4 and No. 5. Also note that the female die, No. 4, is designed so that it can be extended for use in both the first and second operations. The use of complicated double-action or cam dies is becoming common with the availability of more powerful machines, but it must be remembered that the power limitations of the machine must be known when designing such dies.

Figure 10 shows a design called for by a refrigerator body sheet, incorporating seven operations in one setup while allowing the use of standard punch and shear units. The handling time is appreciably lowered in such a setup. The saving in die costs due to the use of standard adjustable units is appreciable, though not so great as the reduction in operation time. Here also can be seen the low cost incurred when product design is changed. Any punch or die may be removed for replacement (or sharpening) without disturbing the rest of

Fig. 5. The three basic types of Press Brake tools for radius bending.

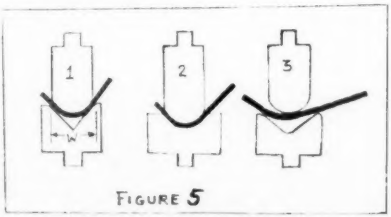


FIGURE 5

Fig. 6. A spring pad incorporated in the V-die prevents proportionately light metals from bulging away from the radius forming punch. Courtesy, The Cincinnati Shaper Company.

Fig. 7. The type of tool shown in Fig. 5, No. 3, is used to form this cylindrical section. Courtesy, The Cleveland Crane & Engineering Company.

Fig. 8. In the forming of these conical sections, the operator is guided by the index marks on the flat blanks. Courtesy, The Cleveland Crane & Engineering Company.

the setup. In those applications where the piece is symmetrical, half a die may be constructed and the work finished with two strokes of the press.

It must be remembered that such operations as multiple punching and shearing are designed for the modern, high tonnage machines and that care must be taken to protect from overloading or setting dies too close at bottom. A practical formula for bending at right angles is:

$$\text{average tons pressure per linear foot} = \frac{\text{metal thickness} \times \text{ultimate strength}}{125 \times \text{die ratio}}$$

where the die ratio is the die opening divided by the metal thickness (see Figure 5: where W, divided by metal thickness, equals die ratio). The most commonly used, and frequently most satisfactory, die ratio is 8, lower ratios usually leading to marred metal surfaces. The ultimate strength of the material varies with that used, but the following figures are satisfactory. Mild steels have an ultimate strength of 55,000 to 65,000 psi, soft brass 30,000 psi, soft aluminum 20,000 psi, heat treated aluminum 60,000 psi, and stainless steel 90,000 psi.

The chart, Figure 11, is the result of a great many tests and gives average values for mild steel having a tensile strength of 55,000 to 65,000 pounds psi.

The bending pressure varies directly

Fig. 9. Several Press Brake tool profiles for performing typical multiple operations.

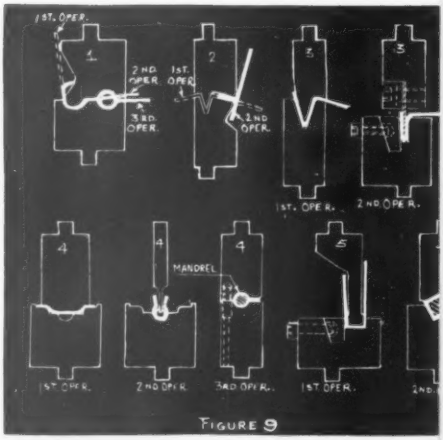


FIGURE 9

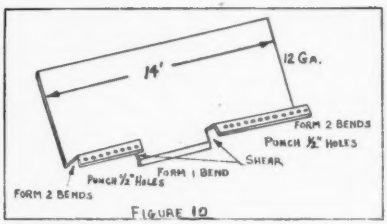


Fig. 10. This refrigerator body sheet results from seven Press Brake operations in one setup, incorporating standard punch and shear units.

as the tensile strength regardless of whether the material is a straight carbon steel, a high tensile alloy steel, or a stainless steel. For example: for any material having a tensile strength of approximately 90,000 pounds psi, the figures in the chart should be increased 50 percent.

The inside radius of a bend is approximately $\frac{5}{32}$ of the female die opening regardless of the gauge of the metal being formed. To illustrate: if a ⅛" plate and a ¼" plate are being formed over a 2" die, each will have the same inside radius, approximately $\frac{5}{16}$".

When bending ordinary mild steel plates more than ½" thick it is generally necessary to use a die opening greater than eight times the thickness of the plate to prevent fracture. High tensile steel plates, even in the thinner gauges, must be formed over die openings ten to twelve times their thickness.

Special flanging or boiler steel is often used to eliminate breakage when necessary to bend heavy plate over a small

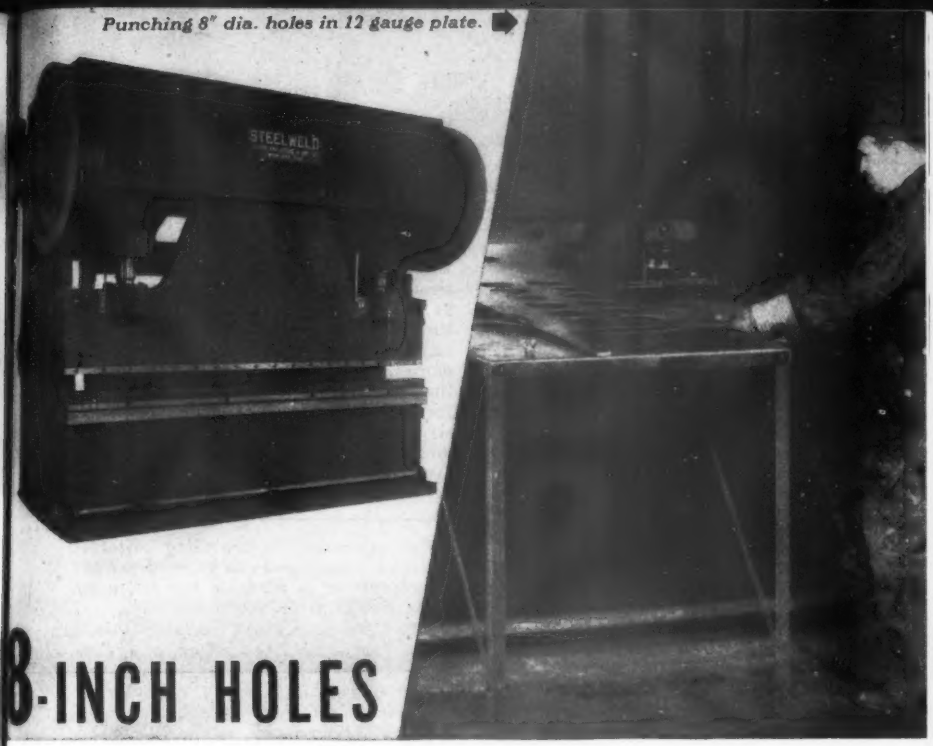
Fig. 11. Tons pressure required per linear foot to bend mild steel of 55,000 to 65,000 psi tensile strength. The tonnages underlined are for V-die openings eight times the thickness of the metal. This ratio is generally used in right angle bending to attain an inside bend radius approximately equal to the thickness of the metal. Courtesy, The Cincinnati Shaper Company.

Thickness of Metal		Width of Vee Die Opening																							
Gauge	Inches	¼"	⅜"	½"	⅝"	¾"	⅞"	1"	1⅛"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"	7"	8"	10"	12"
20	0 036	3 1	2 3	1 7	1 4	1 1																
18	0 048	5 3	4 0	3 0	2 5	2 2	1 7	1 3														
16	0 060	9 6	7 1	5 6	4 5	3 8	2 8	2 2	1 8	1 5												
14	0 075		11 9	9 2	7 6	6 3	4 7	3 5	3 0	2 5	2 1	1 8										
12	0 105				16 7	13 1	9 7	8 0	6 5	5 6	4 6	4 1	3 2									
11	0 120				19	2 14	2 11	1 9	9 6	7 5	6 3	5 5	4 4	2 9								
10	0 135					18 6	14 5	11 9	9 9	8 5	7 3	5 8	4 0									
3/16	0 188						27 4	23 1	19 3	16 4	14 3	11 2	7 5	5 7	4 4							
¼	0 250							39 4	33 3	29 5	22 7	15 4	11 4	9 0	7 4	6 1						
5/16	0 313								50 4	39 8	27 0	19 7	15 3	12 7	10 5	7 7						
3/8	0 375									61 6	42 3	30 9	24 0	19 6	16 3	12 3	9 5					
7/16	0 438										61 7	45 8	35 4	28 6	24 4	17 3	14 8	11 2				
½	0 500										85 2	63 6	48 8	39 7	33 3	24 6	19 4	15 9	13 1			
5/8	0 625											110 0	86 2	70 0	58 3	43 1	33 3	27 4	23 3	16 9		
¾	0 750												138 0	110 0	93 0	68 7	53 5	43 6	36 5	27 1	21 0	
7/8	0 875													165 0	137 0	104 0	80 7	64 6	52 9	39 7	31 6	
1	1 000														197 0	143 0	113 0	91 2	76 2	56 3	44 2	

Thickness of Metal		Hole Diameter																
Gauge	Inches	⅛"	5/32"	¼"	11/32"	⅜"	13/32"	½"	17/32"	9/16"	19/32"	¾"	25/32"	⅞"	29/32"	1"	1⅛"	1¼"
20	036	35	53	71	88	1 1	1 2	1 4	1 6	1 8	1 9	2 1	2 3	2 5	2 7	2 8		
18	048	47	71	94	1 2	1 4	1 7	1 9	2 1	2 4	2 6	2 8	3 1	3 3	3 5	3 8		
16	060	59	89	1 2	1 5	1 8	2 1	2 4	2 7	2 9	3 2	3 5	3 8	4 1	4 4	4 7		
14	075	74	1 1	1 5	1 9	2 2	2 6	2 9	3 3	3 7	4 1	4 4	4 8	5 2	5 5	5 9		
12	105	1 0	1 6	2 1	2 6	3 1	3 6	4 1	4 7	5 2	5 7	6 2	6 7	7 2	7 7	8 3		
11	120	1 2	1 8	2 4	3 0	3 5	4 1	4 7	5 3	5 9	6 5	7 1	7 7	8 3	8 8	9 4		
10	135		2 0	2 7	3 3	4 0	4 6	5 3	6 0	6 6	7 3	8 0	8 6	9 3	10 0	10 6		
3/16"	187		2 8	3 7	4 6	5 5	6 5	7 4	8 3	9 2	10 2	11 1	12 0	12 9	13 8	14 8		
¼"	250			4 9	6 2	7 4	8 6	9 8	11 0	12 3	13 5	14 8	16 0	17 2	18 5	19 7		
5/16"	375					11 1	13 0	14 8	16 6	18 5	20 3	22 1	24 0	25 8	27 7	29 5		
⅜"	500						17 2	19 7	22 1	24 6	27 1	29 5	32 0	34 4	36 9	39 4		
7/16"	625									30 8	33 8	36 9	40 0	43 0	46 1	49 2		
½"	750											44 3	48 0	51 7	55 4	59 0		

Fig. 12. Tons pressure required for hole punching in mild steel plate having a shearing strength of 50,000 psi. Courtesy, The Cincinnati Shaper Company.

Punching 8" dia. holes in 12 gauge plate.



8-INCH HOLES

with a BENDING PRESS

There are other ways to make large holes in steel plate but many Steelweld owners find their press handles this work easily and speedily. Best of all, when the job is done the dies can be changed quickly and the machine set up to make sharp bends, smooth curves, corrugate or other forming operations.

In most shops Steelwelds are never idle. They are NOT one-purpose machines. When one job is completed, there is always another ahead for Steelwelds. They are versatile tools easily adapted to practically every plate-forming operation.

Steelwelds are not only "Jack of all" metal-forming jobs, but they are "master" of them as well, for they are accurate, efficient and easy to operate.

Get the facts on Steelwelds. See what they can do for you.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1114 EAST 283RD STREET • WICKLIFFE, OHIO.

STEELWELD

BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

die opening.

When making a 90 degree bend the pressure rises very rapidly. It reaches 85 percent of maximum when the metal is bent only 20 degrees; and the maximum when bent 40 degrees. The pressure drops only a few percent when the metal is bent to 90 degrees.

If the dies are struck solidly together, there is no limit to the applied pressure.

When channel or double offset bends are formed the load may run to as much as ten times that required for a simple 90 degree bend due to the drawing effect, and care must be exercised in setting up for multiple bends of this nature.

A practical formula for hole punching tonnage on a mild steel of 60,000 lbs ultimate strength is as follows:

tonnage = hole dia × plate thickness × 80 × no. of holes.

In Figure 12 is shown the tons pressure required for a variety of hole punching specifications.

The tonnage requirement of other metals will be directly proportional to the ultimate strengths listed above.

Consideration must be given to the fact that press brake capacity for punching is not as great as it is for bending, due to the "sling-shot" effect upon breakthrough in punching.

A practical method for considerably increasing the punching capacity of a machine is arranging the punches in two, three or four levels, thereby proportionately reducing the tonnage requirement. If the hole is not circular, replace hole diameter in the above formula by a factor equal to one-third the length of outline to be punched.

To obtain the total pressure required for one-level punching, multiply the pressure shown in the chart by the number of holes to be punched. The resultant tonnage should not exceed approximately two-thirds the rated capacity of the brake for smooth operation.

If punches are stepped one-half of the metal thickness or more, the total pressure will be reduced as follows: punches on two levels, divide by 2; punches on three levels, divide by 3; punches on four levels, divide by 4.

When operating the machine certain safety rules should be observed both for maintenance of equipment and for safeguarding the operator. Always leave a press brake at the bottom of its stroke, so that if the clutch should become engaged the ram will start upward. Where a variable speed drive is available with the equipment, it is possible, by slowing down the stroke, to bend narrow flanges without danger from whip-up of wide sheets. Also, the number of strokes can be set so that the operation will be continuous at a speed whereby the operator can feed a piece at each stroke. When more than one operator works at a press, the operator of the clutch is responsible for all hands before beginning each stroke. Efficient rubber or spring stripping will materially reduce punch breakage since the punch on both sides of a defective stripper is affected. If the die

For assistance in providing editorial material, photos and charts, grateful acknowledgment is made to the following Press Brake manufacturers:

The Cyril Bath Co., Cleveland, Ohio

The Cincinnati Shaper Company, Cincinnati, Ohio

The Cleveland Crane & Engineering Co., Wickliffe, Ohio

From them readers may obtain upon request detailed specifications covering Press Brakes in a great range of capacities.

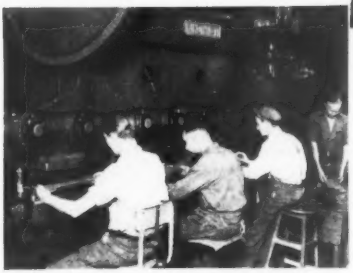
ratio is too much below 8, or if the male is allowed to bottom to too great a degree, scuffing of the metal will result. Soft steel dies cost less to start with, but are soon distorted so that the cost of re-machining and the loss of time makes their use poor economy. Heat treated and drawn forgings at about 200-235 Brinell are available at somewhat greater cost, but machinability must be taken into account. Several of the special chrome-moly alloys are practical, such as Kromite No. 3 which is machinable to 321 Brinell.

With the design of suitable standard or special dies to fit the job and with the use of a press of sufficient rated capacity for the application, it will be found that in both short and long run jobs the press brake can be made to do many types of operations most economically with a minimum outlay for tooling.

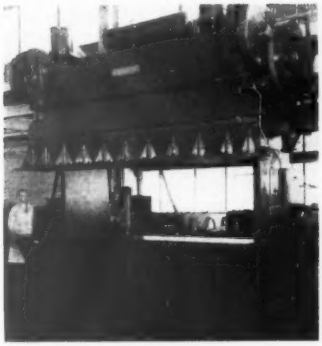
Use a Press Brake...

FOR BENDING

FOR MULTIPLE PUNCHING



FOR PROGRESSIVE FORMING, PUNCHING, NOTCHING



FOR PRESS WORK

Many a job is best on a Cincinnati Press Brake. This versatile machine forms, bends, corrugates, punches, notches . . . using simple low-cost dies for jobbing work, or progressive and multiple dies for quantity production.

Its wide utility reduces manufacturing costs . . . its unusual accuracy pays on the assembly line . . . it's a producer of double dividends.

Write for Brake Catalog B-2.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

TDJ SHOP DATA SHEET NO. 51

Screw Thread Standards, N. P. T. Details

	A	B & C	D	E	F	G	H	I
1/16—27	.160	.2611	.3125	.3008	.2515	.2373	15/64	.3896
1/8—27	.180	.2639	.405	.3931	.3451	.3270	11/32	.3924
1/4—18	.200	.4018	.540	.5218	.4454	.4225	7/16	.5946
3/8—18	.240	.4078	.675	.6564	.5825	.5572	9/16	.6006
1/2—14	.320	.5337	.840	.8155	.7213	.6829	45/64	.7815
3/4—14	.339	.5457	1.050	1.0248	.9317	.8972	29/32	.7935
1 —11 1/2	.400	.6828	1.315	1.2832	1.1690	1.1278	1 3/64	.9845
1 1/4—11 1/2	.420	.7068	1.660	1.6267	1.5138	1.4714	1 31/64	1.0085
1 1/2—11 1/2	.420	.7235	1.900	1.8656	1.7527	1.7103	1 47/64	1.0252
2 —11 1/2	.436	.7565	2.375	2.3385	2.2267	2.1832	2 13/64	1.0582

	Pitch Dia at E Small End External Threads	Pitch Dia at F Large End Internal Threads	Pitch Dia at G Small End Internal Threads	Thread Depth 0.80000P
1/16—27	.2712	.2812	.2642	.0296
1/8—27	.3635	.3748	.3566	.0296
1/4—18	.4774	.4899	.4670	.0444
3/8—18	.6120	.6270	.6016	.0444
1/2—14	.7584	.7784	.7450	.0571
3/4—14	.9677	.9889	.9543	.0571
1 —11 1/2	1.2136	1.2386	1.19733	.0696
1 1/4—11 1/2	1.5571	1.5834	1.5408	.0696
1 1/2—11 1/2	1.7961	1.8223	1.7798	.0696
2 —11 1/2	2.2690	2.2963	2.2527	.0696

The above data courtesy The Flex-O-Tube Company, Detroit, Mich.

A—Length of perfect internal and external threads.

B—Full length of internal effective threads, or wrench makeup.

C—Full length of external effective threads.

D—OD at back of external threads.

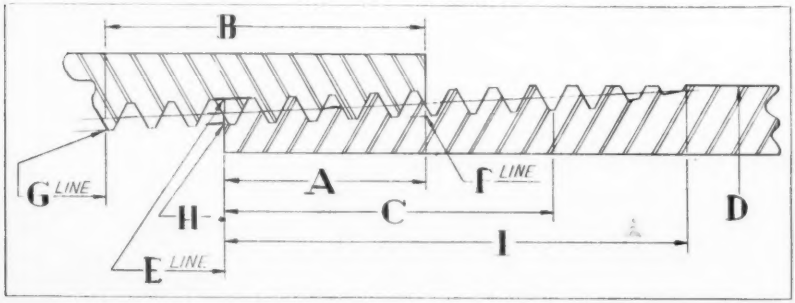
E—OD at front or small end of external threads.

F—ID at large end of internal threads.

G—ID at small end of internal threads or OD at small end of tapered ID cutter. Brass will require no tapered cutter.

H—This is your tap drill size which will give usable threads with slight imperfect crest, from 'E' line to 'G' line.

I—Total length of external threads.



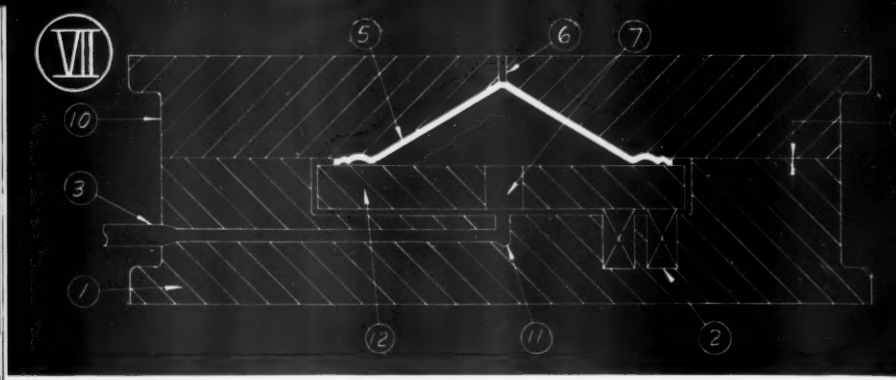
TDJ SHOP DATA SHEET NO. 52

Induction and Dielectric Heating Data, Physical Constants of Metals

(20° C Unless Otherwise Specified)

Material	Resistivity Microhms/CC	Temp. Coefficient of Resistance	Specific Gravity	Specific Heat	Coefficient Thermal—Cond.
Aluminum	2.688	.00403	2.70	.214	.5
Barium	9.8	.0033	3.78	.068	....
Beryllium	10.1	.....	....	.397	....
Brass	8	.002	8.6	.092	.204
Bronze	17.8	.0005	8.8	.086	....
Carbon	3500 at 0°	.0009	3.52	.165	....
Calcium	4.59	.00364 (0—600)	1.54	.157	....
Chromium	2.6 at 0°	.....	6.92	.11	....
Cobalt	9.7	.00658 (0—100)	8.71	.10	....
Copper	1.724	.00393	8.89	.0921	.918
Gold	2.44	.0034	19.3	.0312	.7
Graphite	800 at 0°	.....	2.25	.17	....
Iron	9.8	.0065 (0—100)	7.8	.107	.161
Iron Cast	79.104	.....	7.03	.118	....
Lead	22.0	.0039	11.4	.0306	.083
Magnesium	4.46	.004	1.74	.246	.376
Manganese	5	.....	7.42	.121	....
Mercury	95.8	.00089	13.59	.033	.015
Molybdenum	5.08 at 0°	.0047 (0—100)	9.0	.065	.346
Monel Metal	42	.002	8.9	....	.062
Nickel	7.8	.00537 (20—100)	8.9	.105	.142
Platinum	9.83 at 0°	.003	21.4	.0324	.166
Potassium	6.1 at 0°	.0055 at 0°	.851	.19	....
Silver	1.629 at 18°	.0038	10.5	.056	1.0
Sodium	4.3 at 0°	.0054	.951	.295	....
Steel (Soft)	11.8	.004	7.7	.118	.115
Steel (Hard)	45.6	.0016	7.7	.118	.115
Steel (Nickel)	30—85	.0007	7.7	.118	.115
Tantalum	15.5	.0031	16.6	.036	.130
Thallium	17.6 at 0°	.0040 at 0°	11.86	.038	....
Thorium	18	.0021 (20—1800)	11.5	.027	....
Tin	11.5	.0042	7.3	.054	.155
Tungsten	5.5	.0047 (0—100)	19	.034	.476
Zinc	5.75 at 0°	.0037	7.1	.093	.265

Note: Data compiled by the Industrial Electronics Division, Westinghouse Electric Corporation, Baltimore, Md.



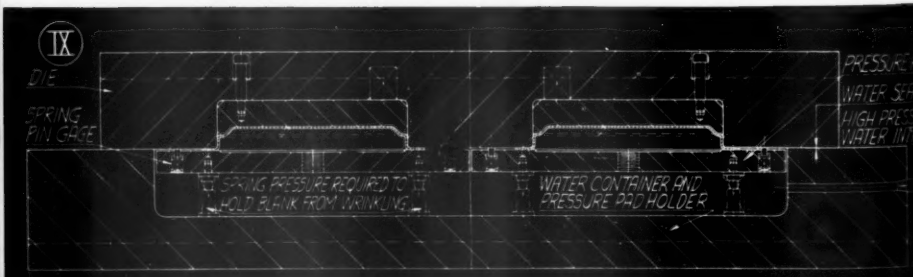
(CONTINUED FROM PAGE 80)

FIGURE VIII. It is possible to draw two or more stampings with a multiple die and a fluid chamber having corresponding pressure pads.

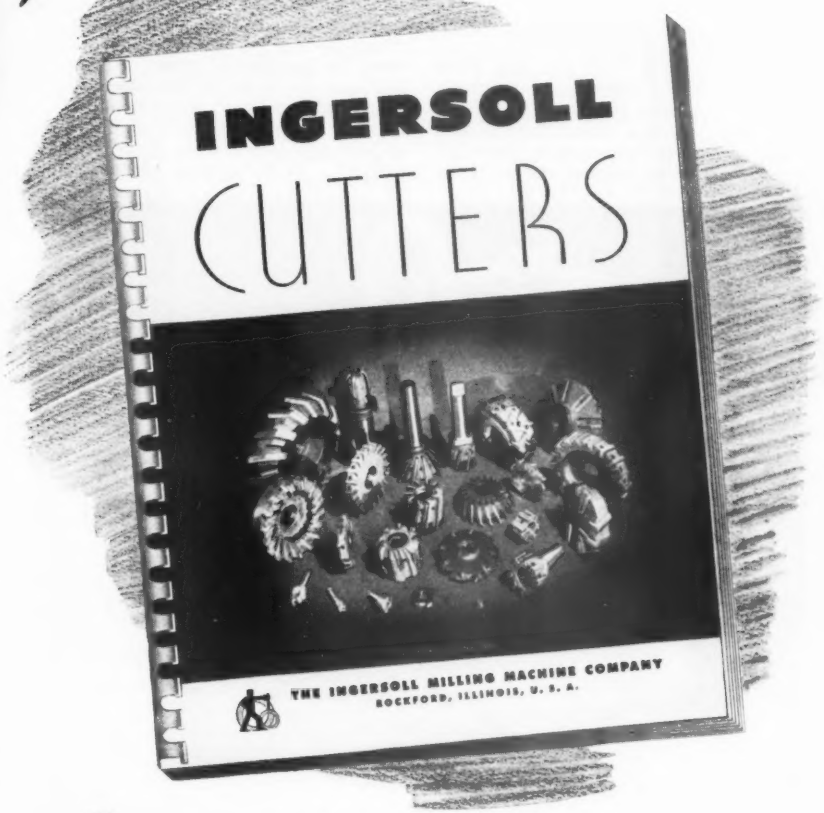
FIGURE VII. Showing how, by Hydrodynamic tooling, this 18-8 stainless steel cone was made in one operation. It presents a graphic example of the flexibility of the fluid punch which starts out as a 21" flat punch and, as the metal draws, changes in shape, continuously and symmetrically, to its final form. The savings and efficiency are obvious: no metal punch, no annealing and pickling between operations; there are no redraw marks and the angles are held exactly.

For complete information relating to licensing this new stamping process, write S. B. Whistler & Sons, Inc., 752-756 Military Road, Buffalo 17, New York, or use Inform-A-Gram Key No. 88-Q.

FIGURE IX. This tool section is for producing the two 8" x 12" stampings of Figure VIII from 61-sw aluminum alloy. Note that the water seal prevails only between the multiple cavity die and the fluid chamber and that the two pressure pads and supporting spring assemblies are within the one fluid chamber.



Just Off the Press!



Send Today... **FOR YOUR COPY**

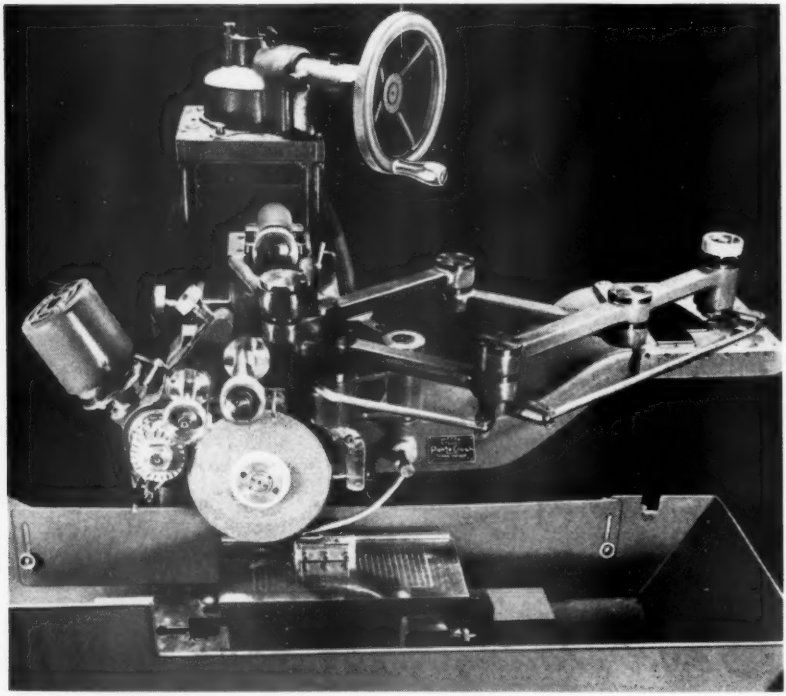
of this new Ingersoll Cutter Catalog

THE **INGERSOLL** MILLING MACHINE CO., ROCKFORD, ILL.

Builders of Inserted Blade Milling and Boring Tools

Accuracy of Diamond Dressing Combined with Economies of Crusher Roll Form Grinding

The Moore Panto-Crush grinding wheel dresser employs precision pantograph control to initially impart the specified form to the grinding wheel. The diamond dressed wheel is then used to grind the workform into the crusher roll which, in turn, is capable of many subsequent touch-up dressings of the wheel in the course of grinding workpieces to the finished form, from the solid. In cases of extreme tolerance such as may be called for in the making of flat formed



The Moore Panto-Crush Wheel Dresser mounted on a surface grinder. The relationship of the flat stylus to the flat template may be seen under the extreme right end of the pantograph arm. In addition to the pantograph proper, two linkage members that permit angular coordination between the axis of the stylus and the axis of the diamond dresser extend from the stylus pivot assembly to the diamond supporting pivot. Outboard at the left is the power drive for the crusher roll. The crusher is fed into the wheel by means of an eccentric cam, turned by hand. Contours 1/8" wide may be formed without extending the template beyond the table.

tools, the diamond dresser is used to true the wheel to the master template just before the finishing pass over the work.

Wherever the crusher roll needs regrinding, the wheel is profiled by the pantograph-actuated diamond to insure that the roll will be a faithful reproduction of the master template.

Working from a master template, manipulation of the stylus on the long arm of the pantograph controls the movement of the diamond dresser point, which is, correspondingly, the short arm of the pantograph. The pantograph ratio is 10 to 1, hence the template of the form to be dressed into the wheel is a ten-time enlargement of the wheel or work profile.

The only great skill needed in the Panto-Crush method of generating a wheel form is that of making the master template; and because any errors that may exist in the master template are reduced to one-tenth on the wheel, it is relatively easy and economical to produce wheel forms to any degree of accuracy required.

The pantograph construction includes super-precision, pre-loaded ball bearings, set up to give the greatest rigidity consistent with sensitive operation. The master template is mounted on a flat, horizontal surface. The stylus or follower is also flat and its tracing point, which is kept in engagement with the edge of the template, is of a radius ten times that of the dressing diamond point. The diamond dresser, in addition to faithfully reproducing the travel of the stylus, also always assumes the same relative position of approach to the wheel that the stylus makes to the edge of the master template.

Two series of radius diamond tools and styli are available; i.e., of 90° and 60° included face angle. The stylus angle is slightly greater than the diamond angle to assure that the stylus will always lead the sides and shank of the diamond.

The power driven crusher roll drives the wheel spindle by friction. The question whether the roll should drive the wheel or be driven by the wheel resolves itself simply to whichever rotates most

A collection of form-ground tool parts and crusher rolls as produced on the Moore Panto-Crush Wheel Dresser. The device does not have to be removed to use machine as conventional surface grinder. Forms similar to the template, but larger or smaller, may be ground by slightly advancing or retracting the diamond holder. For example, die, stripper and punch holder forms in a given die are similar but larger or smaller due to specified cutting clearances or press fits between parts. Also, crusher roll may be profiled deeper than desired finish form, to provide a roughing allowance on the workpiece prior to finish-grinding.

easily. In the first place, roll crushing requires anti-friction bearing spindles because of their better axial and radial rigidity; moreover, the wheel is large in diameter and very little torque is required to turn it, hence this action produces true rolling yet does not require any auxiliary slow-speed drive for the grinding spindle. Another advantage in power-driving the roll rather than the wheel is that the roll spindle serves as the arbor for grinding and regrinding the roll, as well as for grinding other work such as circular form tools. The crusher roll may be reground as often as necessary to maintain true form, or whenever it is removed or replaced.

Readers may obtain additional details, specifications, and application and installation information from the MOORE SPECIAL TOOL CO., INC., Dept. 5-89, 1726 Union Ave., Bridgeport 7, Conn., or by use of our postage-free INFORM-A-GRAM Key No. 589-Q.

(CONTINUED FROM PAGE 86)
evolved that will truly correlate the performance of different machine finishes. This is largley due to the fact that so many factors are involved. Different materials, various types of finishes and thousands of applications make the problem of correlating performance more difficult.

Further, no agency has ever taken over a project to make a thorough and careful study of the results and observations of the many investigators. No attempt has ever been made to correlate them, to make tests to confirm or discount their findings, or to determine if there might be a sound fundamental basis on which such performance can be measured and predicted.

As a result, it is doubtful if the so-called RMS (root-mean-square) average deviation from the mean in micro-inches (which is the generally acceptable unit for machine finish designation) is really any better than the ordinary arithmetical average as an index to the roughness of any machined surface. Until research establishes the best index, surface finish measuring instruments will have to base their readings on existing units.

A recent survey conducted among the leading aircraft manufacturers by the National Aircraft Standards Committee revealed a preference for using the arithmetical average by a vote of 21 to 2. This preference was solicited in the interest of simplification, since it appears that the difference between the two units is less than the acceptable tolerances and within the accuracy range of existing instrumentation.

The practical man should not allow these facts to worry him unduly, for with any given instrument he can control the processing of his product within extremely close limits. By making samples of the surfaces that have given satisfactory performance, he can, by direct instrument comparison, keep all further production under control. This is particularly true for very fine surfaces that are very essential to the continued satisfactory performance and life of his product. The Profilometer, manufactured by Physicists Research Company of Ann Arbor, Michigan, and the Brush Surface Analyzer, manufactured by the Brush Development Company, Cleveland, Ohio, are tracer point surface finish measuring instruments suitable for such work. The Comtor Surface Finish Comparator, manufactured by the Comtor Company of Waltham, Massachusetts, is one of the reflectivity or gloss meter types of comparators. It is equipped with a light source and a photoelectric cell which measures the light reflected from the surface to be compared with the sample. The meter reading serves as an index to the surface roughness.

While nothing will take the place of these precision instruments in measuring or shall we say comparing the surface roughness of very fine machine finishes, there are many rougher surfaces that also need adequate control in the shop.

Many manufacturers have found that the procurement of sets of standard surface finish samples for distribution to their workers has solved the problem as far as the average machine finishes are concerned. This can usually be done for an expenditure of considerably less than one hundred dollars if the plant is not too large, whereas even one tracer point analyzer costs over a thousand dollars. In many cases, even such an expense is justified as some manufacturers have dozens of tracer point analyzers in one department. In other cases it may not be justified, and for those the use of standard roughness samples accomplishes the required control.

Both methods, however, require the use of a proper system of drawing designation. One method now in use is described in my text titled "Control of Surface Quality" available from the Surface Checking Gage Company, Hollywood 28, California. Such a method of drawing designation and quality control can be accomplished by using standard roughness samples as reference. There are several types available and any of these that appeal to the user can be used in such a program. Those of the University Machine Company, Cambridge, Massachusetts, are the best stainless steel machined specimens I

(CONTINUED ON PAGE 170)

Quality Control— The Watchdog of Production

The tools of quality control are essential to the maintenance of production to prescribed tolerances. For this purpose, accuracy and dependability *must* be built into every tool and gage.

Specialists in tooling for quality control, Tools & Gages, Inc., maintains a complete inspection laboratory, scientifically conditioned to eliminate temperature variations and thus assure positive accuracy.

Experienced toolmakers, working with the most modern equipment and employing master gages measuring in millionths of an inch, will provide you with quality control tooling to your most exacting specifications.

Tools & Gages, Inc., has served industry for over 25 years by building the precision tools, gages, jigs and fixtures vital to low cost mass production.

Phone, wire or send blueprints for immediate quotations and accurate delivery commitments.

BUILDERS OF PRECISION TOOLS GAGES • • JIGS • • FIXTURES

TOOLS *and* GAGES

INCORPORATED

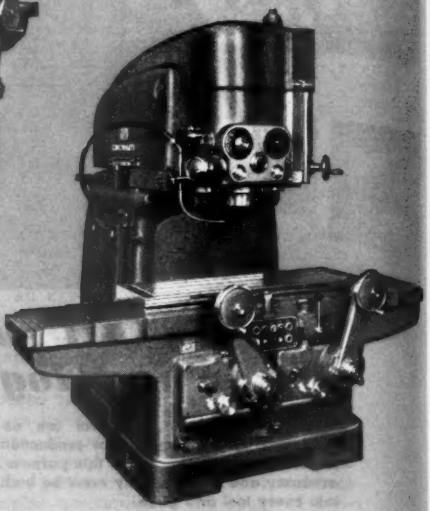
3112 EAST 63rd STREET • CLEVELAND 4, OHIO

MICHIGAN 7230

ANOTHER

DIE-SINKING

CINCINNATI 16-30 Vertical Hydro-Tel Die-Sinker with Automatic Depth Control Unit.



GENERAL PURPOSE MILLING

CINCINNATI 16-30 Vertical Hydro-Tel for general purpose milling.

● The CINCINNATI 16" series Vertical Hydro-Tel Milling Machine, a recent addition to Cincinnati's complete line of milling machines, is built in three styles: 1) general purpose milling machine; 2) die-sinking machine; 3) automatic 360° profiling machine. It offers many features which effect production economies on a wide range of vertical milling operations. To mention a few of the features: finger-tip operation of table and cross slide through "Servo" hydraulic control; infinitely variable feed rates; fixed height table; centralized controls; sixteen spindle speeds; quick change adapter for spindle nose; automatically lubricated ways, and others that are equally important. ¶ It will pay you to investigate the new CINCINNATI 16" series Vertical Hydro-Tels for your vertical milling, die-sinking and profiling operations. Complete details on all features and engineering specifications on all three machines are contained in catalog M-1497. Write for your copy today! For a brief description of this machine, look in Sweet's Catalog File for Mechanical Industries.

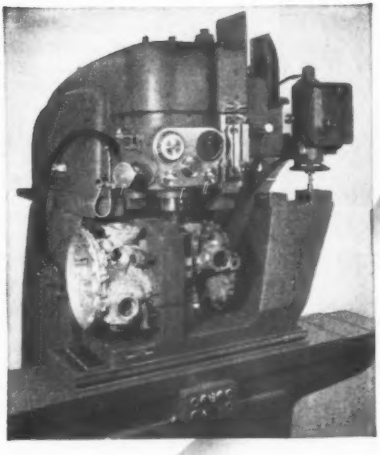
ADDITION TO CINCINNATI'S LINE OF MILLING MACHINES

The 16" Vertical Hydro-Tel

IN 3 STYLES

PROFILING

CINCINNATI 16-30 Vertical Hydro-Tel with 360° profiling equipment tooled up for milling a complex profile.

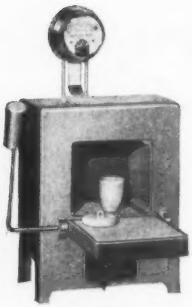


CINCINNATI

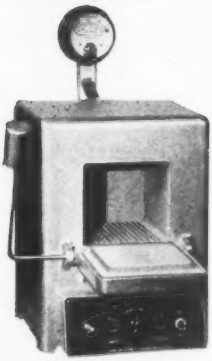
THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

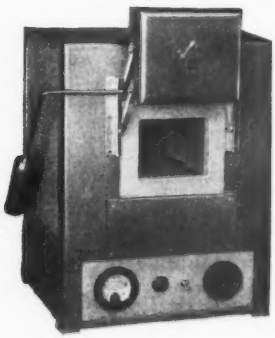
MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES



MODEL GTP



MODEL CEA



MODEL OFE

TEMCO

ELECTRIC FURNACES

With the new TEMCO stepless control you can select and hold any desired temperature.

Model GTP—interior 4" x 3¾" x 3¾". May be operated continuously up to 1500° F. and intermittently to 1850° F. Embedded heating element. Power consumption 1.2 kw. Cast aluminum body. Weight 15 pounds.
For 115V A.C.....**Price $57.50**
Also available for 230V and D.C.

Model CEA—interior 4¾" x 4¼" x 6". Maximum continuous temperature 2000° F. Element is embedded for its protection and surrounds muffle chamber for uniform heating. Power consumption 1.5 kw. maximum. Insulated aluminum body. Weight 31 pounds.
For 115V A.C.....**Price $80.00**
Also available for 230V and D.C.

Model OFE—interior 6" x 5" x 10". Maximum temperature 1600° F. continuous, 1900° F. intermittent. Synchronous motor driven control. Heating element covers four sides of chamber. Steel frame with 4½" insulation. Maximum power consumption 2.2 kw. Weight 130 pounds.
For 115 or 230V A.C.....**Price $194.00**

TEMCO furnaces have low initial cost and are economical to operate as nearly all the power is consumed within the heating chamber. They are fast heating and ideal for general laboratory uses, heat-treating and small unit production.

See your supply house or write for literature giving detailed specifications

486 WEST LOCUST ST., DUBUQUE, IOWA

THERMO ELECTRIC
MANUFACTURING COMPANY

INDUSTRIAL DIGEST

Science • Research • Methods • Tooling • Production • Trade News and Reports

OPA on Special Machinery and Special Tools

From a special bulletin, dated July 31, 1946, issued to members by the office of George S. Eaton, Executive Secretary, National Tool & Die Manufacturers Association, 14121 Union Commerce Bldg., Cleveland 14, Ohio:

"By Amendment 33 to SO 129, OPA suspended ceilings on 'Tools and machinery, specially designed, subject to MPR 581'. This item was included to cover such equipment sold by manufacturers of special tooling, as no other machinery is included under MPR 581, which applies essentially to industrial services.

"Likewise, *repair and maintenance work has been removed from price control.*

"From phone conversations with the OPA officials in charge at Washington, we understand that ceilings are now suspended on all special tools, dies, jigs, fixtures, molds, gauges, and special machinery sold by manufacturers of special tooling equipment, *provided no customer's material is used.*

"If any of the material belongs to the customer, OPA now takes the position that the work must be classified as an industrial service, from the legal standpoint, no matter how ridiculous this is practically. And OPA has not lifted controls on industrial services which involve abrading, assembling, cutting, forming, grinding, machining, shaping or welding—no doubt on the ground that the cost of such operations enters directly into the cost of the product.

"We understand the outlook is rather good for decontrol of prices on all machine shop services. Until such action is taken, however, former ceilings remain in effect. *Shop owners may file individual applications for relief wherever needed.* We were informed that under the old law the application could cover only the products still under price control, and presumably the procedure under the extension act will be similar.

"Amendment 33, SO 129, also suspended ceilings on a wide variety of machinery. Included were all machine tools which with standard equipment weigh in excess of 2000 pounds."

High Strength, High Temperature Solder

A german silver-magnesium solder, capable of withstanding temperatures as high as those found inside gas jet turbines, may prove useful to many American manufacturers, according to a report now on sale by the Office of Technical Services, Department of Commerce.

The solder is composed of 85 percent commercially pure silver and 15 percent magnesium. Addition of magnesium in this proportion to pure silver gives the alloy excellent soldering properties without lowering the melting point of the silver. The solder has a melting point of 1790 degrees Fahrenheit and retains its high strength at temperatures up to 850 degrees Fahrenheit.

The solder was used to attach the hollow blades of the Junkers 004 jet engine to the turbine wheel. Pin fastenings alone were not strong enough, and copper welding or the conventional copper-bearing silver solders could not be used because copper causes intercrystalline corrosion of austenitic steel at high temperatures.

The new solder was developed at the Junkers Works, Dessau, and manufactured for them by the Deutsche Gold und

Silber Scheide Anstalt, Hanau. Junkers reported that not a single failure had been traceable to use of the solder.

The report describes the manufacture and use of the solder, as well as the composition of fluxes used in the soldering process.

The Industrial Diamond Association of America, Inc.

The first convention of the Industrial Diamond Association of America, which took place on July 16, 17 and 18 in Detroit's Hotel Book-Cadillac, highlighted the great progress made since the days when the new indispensable abrasive was first used.

It was not so much the emphasis on the many war and civil uses of industrial diamonds that was striking, as the success of the two groups composing I.D.A.; diamond importers and diamond toolmakers harmoniously working together that diamonds might become still more valuable to American Industries, and pooling their resources for research. It was proved beyond a doubt that no other cutting, grinding, or drilling media could compete with diamonds for economy and accuracy.

Research towards further progress and continued improvement of ethical relations within and without the diamond industry were assured by the composition of seven committees appointed by president Harvey B. Wallace (Wheel Trueing Tool Company, Detroit), unanimously approved by Directors.

Productivity Creates Wages

The tenth annual National Time & Motion Study Clinic, sponsored by the research division of the Industrial Management Society, will be held November 7th and 8th, 1946, at the Continental Hotel, 505 N. Michigan Avenue, Chicago, Illinois. Theme of the clinic will be "PRODUCTIVITY CREATES WAGES." Clinic Chairman, Ralph H. Landes. Exhibit Chairman, Lewis M. Glassner. Inquiries may be addressed to the Society offices at 176 W. Adams St., Chicago 3, Illinois.

Iron Powder Plant in Minnesota

In a cooperative program which may set the pattern for future development of natural resources, a modern plant is being built on the Mesabi Iron Range of northern Minnesota for the conversion of iron carbonate slate to pure iron powder. The slate, heretofore a waste product, overlies the iron ore formation and is present in great abundance, uniform in composition and easily accessible.

Continental Machines, Inc., has contracted to operate the plant, which is being built by the State with funds appropriated from the tax on mining ore, administered by the Commissioner of Iron Range Resources and Rehabilitation. Stearns Roger Manufacturing Company of Denver, Colorado, are the contractors constructing the plant which will have an estimated capacity of 5 tons of iron powder per day. The conversion process was developed by the late Charles V. Firth at the Mines Experiment Station of the University of Minnesota.

In a continuous chemical process, susceptible to close control, the iron is dissolved out of the ore by acid, precipitated as crystals of iron sulphate (copperas) and preferentially roasted to iron oxide of high purity. This product is then reduced to iron powder of controlled physical characteristics with a purity of over 99 percent.

Already proved in the laboratory as a means of producing iron powder second to none in adaptability to powder metallurgy fabrication, the process has not yet been operated on a scale large enough to determine production rates and operating costs. The great benefits resulting from the establishment of a year-around metallurgical industry in the Mesabi Range area, and the possibility of development of a new resource, are the incentives for the sharing of the risk of such a new enterprise with an industrial organization which has an outstanding

record in the production and distribution of new tools for industry.

Continental Machines, Inc. has named John R. Daisen president of a new division, Iron Incorporated, to operate the plant and market the product. Everyone connected with the project is confident that the process can yield a pure product at a cost that will result in greatly expanded use of iron powder.

A comprehensive program of research and development is being carried on by the new division for the improvement of powder metallurgy products and fabricating methods.

Preliminary plans for resumption of the Western Metal Congress and Exposition have been completed and the event will be held in the San Francisco-Oakland Golden Gate area for six days beginning March 22, 1947. The last such event was held in Los Angeles in 1941. W. H. Eisenman, managing director of the Congress and Exposition, stated that the two Oakland Civic Auditoriums will be the scene of the fifth such gathering after the lapse because of the war.

Western Metal Congress and Exposition

The Western Metal Congress and Exposition will again be sponsored by the American Society for Metals and will have the active cooperation of West Coast chapters of the nation's leading technical societies.

In the Exposition will be shown a complete cycle of equipment and methods relating to the metals industries, including raw materials, heat treating apparatus and supplies, inspection methods and equipment, machinery, foundry supplies, materials handling, welding and cutting, oil field equipment, small tools and finished products.

Technical programs of the Western Metal Congress will include lecture courses, technical papers and round table conferences of special interest to the metals, aviation, petroleum, chemical, mining and general manufacturing industries. These sessions of the Congress and exhibits in the Exposition will be in the two civic auditoriums at Oakland.

Attendance at the 1941 Western Metal Congress and Exposition was approximately 50,000 and it is expected that the 1947 figures will exceed that total.

Handy

SET-UP STUD AND NUT SET

Saves Set-Up Time

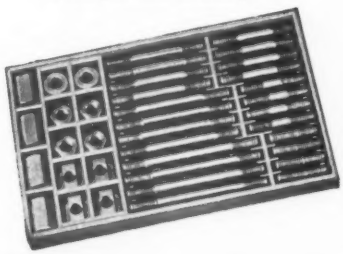
- Case hardened and chrome plated for long life.
- Class 3 threads.
- All sets in individual cases.
- Cases will not damage finest machine bed.
- Each set consists of 4 studs of each of the following lengths — 4", 5", 6", 7", 8"; also 4 nuts, 4 washers, 4-T slot nuts, 4 coupling units.

IMMEDIATE DELIVERY

½" Set - $22.00 ⅝" Set - $24.00 ¾" Set - $26.00

F. O. B. Bedford, Ohio

Write for illustrated folder



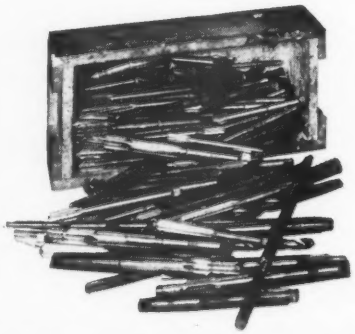
NOBLE & STANTON, INC.

Manufacturers of Tools, Gages and Their Accessories

1002 BROADWAY • BEDFORD, OHIO

NS

WRITE FOR
OUR NEW
CATALOG 46



DON'T SCRAP
WORN AND BROKEN CUTTERS

FOR 34 YEARS WE HAVE SPECIALIZED IN RESTORING DRILLS, REAMERS, COUNTERBORES, MILLING CUTTERS, ETC., TO NEW USEFULNESS

Let us help you reduce your cutting tool costs just as we have for hundreds of others

H. S. S. & TUNGSTEN CARBIDE

REPRESENTATIVES IN ALL INDUSTRIAL CENTERS

NATIONAL TOOL SALVAGE CO.

6511 EPWORTH BLVD. DETROIT 10, MICHIGAN

MANY USES—BIG SAVINGS

CERRO *with* Low Temperature Melting **ALLOYS**

CERROMATRIX—250° F. For securing punch and die parts; anchoring machine parts; short run forming dies, etc.
CERROBEND—158° F. As a filler for bending thin-walled tubing—melts out in boiling water. Also used for automotive and aircraft assembly jigs, forming dies, etc.
CERROSAFE—165° F—190° F. Used for proof-casting cavities in molds, forging dies, duplicate patterns, etc.
CERROBASE—225° F. Used in electroforming dies, molds, etc.
CERROTRU—281° F. Metal molds for wax patterns used to make precision castings.
CERROLOW—117° F—**CERROLOW**—136° F and **CERROLOW**—174° F.

REPRESENTATIVES AND DISTRIBUTORS

ANSONIA, CONN.
L. Heres De Wyk & Co.
89 Main St.

BOSTON 16, MASS.
Robert P. Waller
80 Boylston St.

BROOKLYN 7, N. Y.
Belmont Smelting & Refining Works
330 Belmont Ave.

CHICAGO 6, ILL.
Sterling Products Co., Inc.
121 N. Jefferson St.

CLEVELAND 14, OHIO
Die Supply Co.
5345 St. Clair Ave.

DALLAS, TEXAS
Metal Goods Corp.
2500 S. Ervay

DETROIT 17, MICH.
Castaloy Metal Sales Co.
197 S. Waterman Ave.

HOUSTON 1, TEXAS
Metal Goods Corp.
16 Drennan St.

KANSAS CITY 8, MO.
Metal Goods Corp.
1701 Baltimore

LOS ANGELES 21, CALIF.
Composite Die Supply Co.
1855 Industrial St.

MILWAUKEE 3, WIS.
Williams-Collins, Inc.
2409 State St., W.

MINNEAPOLIS 1, MINN.
Northern Machinery & Supply Co.
Lumber Exchange Bldg.

MOLINE, ILL.
Sterling Products Co.
1524 Third St.

NEW ORLEANS, LA.
Metal Goods Corp.
413 Canal Bldg.

NEW YORK 5, N. Y.
Belmont Smelting & Refining Works
Cerro-Alloy Div.
37 Wall St.

PHILADELPHIA 2, PA.
Jackson Associates
152 N. 15th St.

ST. LOUIS 15, MO.
Metal Goods Corp.
5239 Brown Ave.

TULSA 6, OKLA.
Metal Goods Corp.
19 E. Cameron

TORONTO 8, ONT.
The Canada Metal Co.
721 Eastern Ave.

CERRO DE PASCO COPPER CORPORATION • **40 WALL STREET NEW YORK 5, N. Y.**

The New Procunier "TRU-GRIP" TAP HOLDER

AUTOMATIC
Tap Protection

Reduce Tap Breakage and Damage By Using A Procunier Tapping Head

The new Procunier sensitive high-speed tapping head allows fast, accurate tapping with a minimum of tap breakage. Driving power to the tap is automatically regulated by pressure applied to a special clutch. This clutch engages the conical surfaces of the drive and reverse shells, driving the tap with a soft "cushioned" action, practically eliminating tap breakage. Operators can quickly detect dull or loaded taps by the "feel" or pressure required to drive them—also, the clutch instantly slips, should the tap strike bottom or stick. ***Send coupon for circular giving full details, specifications and prices.***

PROCUNIER PROCUNIER SAFETY CHUCK CO.
12-14 S. Clinton St., Chicago 3, Ill.

A new practical tap holder with many advantages. A broached section of the chuck receives the flattened surfaces on the spring collet, while the tap has a positive drive through the square hole broached in the collet. The tap is always in true alignment—tap shanks are never scored or "chewed up."

SEND FOR BULLETINS

PROCUNIER SAFETY CHUCK CO.
12-14 S. Clinton St., Chicago 3, Ill.

Please send me free bulletins on

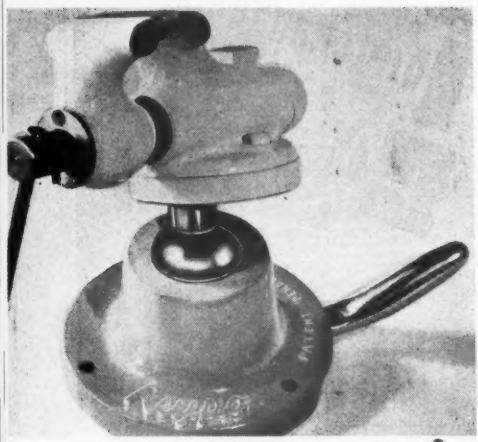
- ☐ Procunier High Speed Tapping Heads
- ☐ Procunier Tru-Grip Tap Holders
- ☐ Universal Tapping Machines.

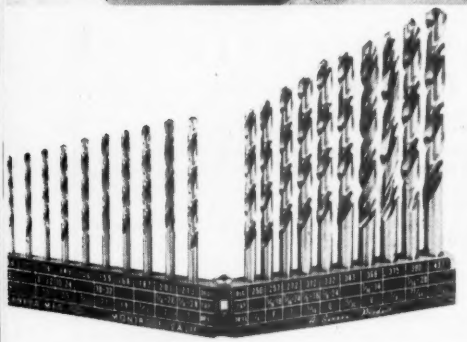
Name.....

Address.....

PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS





FOR FURTHER INFORMATION FILL IN KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT

WHEREVER A QUICK, POSITIVE, UNIVERSAL HOLDING FIXTURE IS REQUIRED, the Reypo Universal Ball Vise, designed for holding work at any angle, will facilitate operations such as filing, fitting, drilling, machining, grinding, assembling, etc. The body of the vise is entirely closed and instant changes in position are made possible by lever lock and release. Literature will be sent by REYPO CORPORATION, Dept. 46, 9900 Lincoln Blvd., Los Angeles 45, Calif., or use INFORM-A-GRAM Key No. J46-Q.

A COMPACT MACHINISTS "GENEVA" DRILL STAND holds 20 of most the used tap and body drills from .106 through .437. Decimal, tap and drill sizes are designated; drill stand folds with drills held firmly in place. The stand is anodized aluminum alloy and a practical addition to every machinists tool kit. Request information from national distributor, GLENN C. HALL COMPANY, Dept. 45, 541 Spring St., Los Angeles 13, Calif., or use INFORM-A-GRAM Key No. J45-Q.

DUPLICATING OF COMPLICATED PARTS, to a high degree of accuracy in a variety of ductile metals and materials, is accomplished with DI-ACRO Brake No. 4, offered in 24" capacity. Special material clamping action and double-edge vertical folding plate make possible the forming of extremely sharp and reverse bends. Precision, speed, and ease of operation are predominant features. Full description is available from O'NEIL-IRWIN MANUFACTURING CO., Dept. 20, 315 8th Ave. S., Minneapolis 15, Minn., or use INFORM-A-GRAM Key No. 20-Q.

STOCK CAN BE REMOVED so cleanly, quickly, and smoothly with the Severance solid tube deburring cutter, that holding work in vises or fixtures is seldom necessary. A one-piece cutter, it was developed to meet deburring requirements such as squaring the tube end to tube centerline or removing burrs without producing chamfer or radius. They may be used in drill presses, drill heads, gear motors and lathes. Write SEVERANCE TOOL INDUSTRIES, INC., Dept. 4-61, Saginaw, Mich., or use INFORM-A-GRAM Key No. 461-Q.

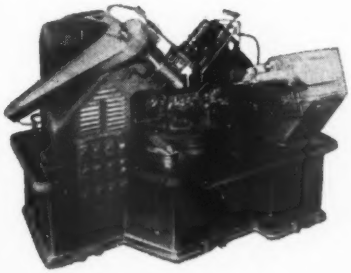
S ON PARADE

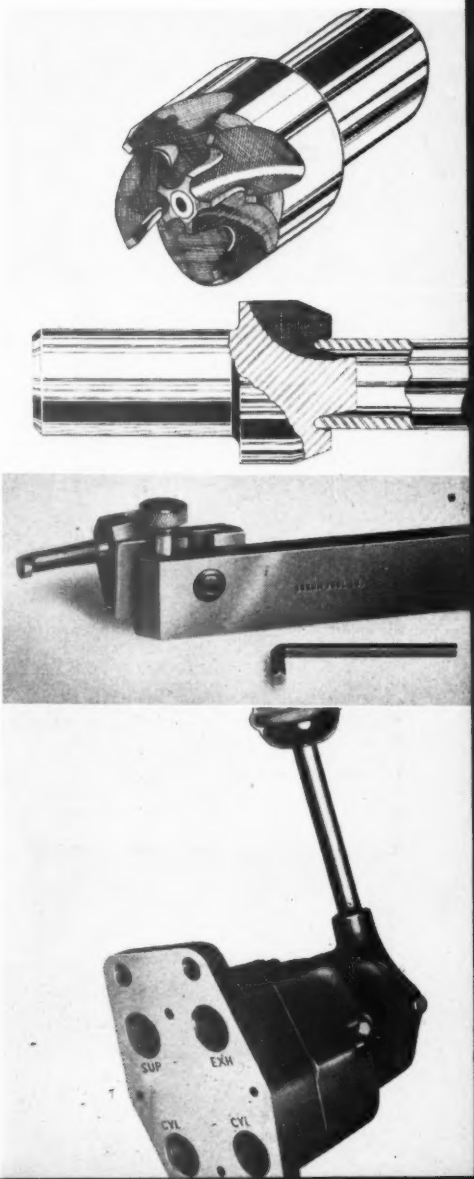
ERS

VERTICAL ADJUSTMENT for boring tools in lathes is provided by a new holder offered in two sizes. Turning a screw moves the tool in a vertical parallel plane to bring it to any precision setting. The adjustment can be made quickly and can be positively locked. Sizes and data are available from BOKUM TOOL CO., Dept. 43, Detroit, Mich., or use INFORM-A-GRAM Key No. A43-Q.

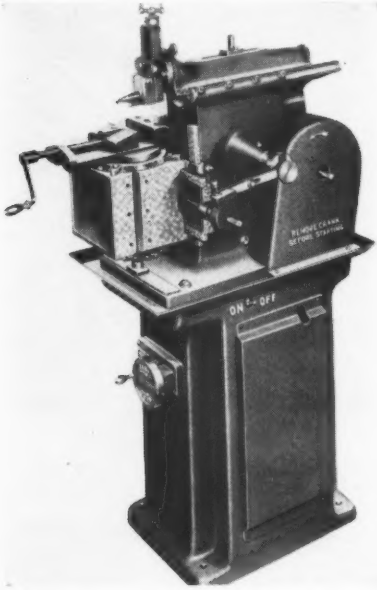
CONTROLLING AIR OPERATED EQUIPMENT is the function of a new 4-way hand-controlled valve developed by Numatics. It is full-ported poppet type. Instead of having the usual four poppets, it has only two. All parts are on one face with both outlet connections at one end to facilitate piping. Since all working parts are contained in the upper housing, the installation of these valves can be made permanent. For full details and specifications write NUMATICS, Dept. 57, Milford, Mich., or use INFORM-A-GRAM Key No. E57-Q.

DRILLING, SPOTFACING, COUNTERBORING AND TAPPING of the vacuum holes in intake manifolds are operations performed on a new special purpose machine built by Hydraulic Machinery, Inc. The cycle of operation is entirely automatic except for loading and unloading. Cycle: (1) part manually loaded and clamped into position, (2) upon closing safety door, electric contact is made and machine automatically indexes to position, all heads moving forward and completing cycle (during cycling time another part is loaded), (3) part is unloaded. Complete details will be sent on request from HYDRAULIC MACHINERY, INC., Dept. 32, 12825 Ford Rd., Dearborn, Mich., or use INFORM-A-GRAM Key No. 32-Q.

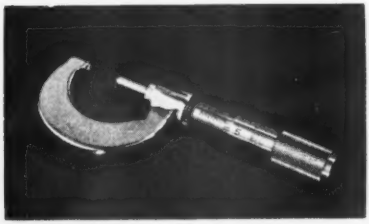




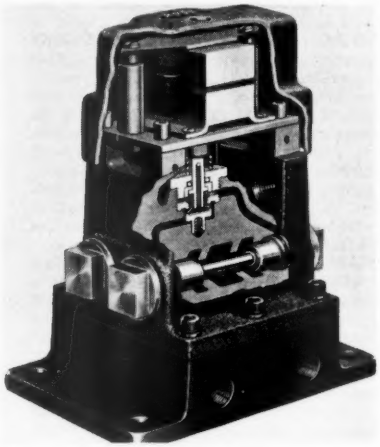
STRAIGHT AND ANGULAR CUTS, SQUARING, MACHINING AND SLOTTING OPERATIONS are handled on a 7" shaper designed to include a variety of work. The Logan Shaper takes heavier cuts smoothly with speed, accuracy and no chatter. It has ample power behind every stroke, positive, slip-proof operation. The tool head may be swiveled and instantly re-set to center. Catalog information is offered by LOGAN ENGINEERING CO., Dept. 2, 4901 West Lawrence Ave., Chicago 30, Ill., or use INFORM-A-GRAM Key No. 2-Q.



GAGING OPERATIONS WITH DIMENSIONAL FIDELITY is the experience back of the Elgin Sapphire Tipt Micrometer. The original micrometer produced is in constant use in a drill plant after 2,000,000 production gagings without showing appreciable wear. The anvil and spindle of this micrometer are tipped with wear resistant sapphire. A request will bring full details from SAPPHIRE PRODUCTS DIVISION, ELGIN NATIONAL WATCH CO., Dept. 89, 932 Benton St., Aurora, Ill., or use INFORM-A-GRAM Key No. C89-Q.

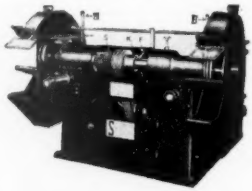


OPERATING SPEEDS up to 400 cycles per minute, with 1.2 amps. at 110 v 60 cycles, are allowed by the Ross piston poppet, pilot operated, solenoid controlled air valve. Small and compact, rugged in construction, all working mechanisms are interchangeable. The model is available in 3-way, 4-way and 4-way (5 port), and in ¼", ⅜", ½" and ¾"



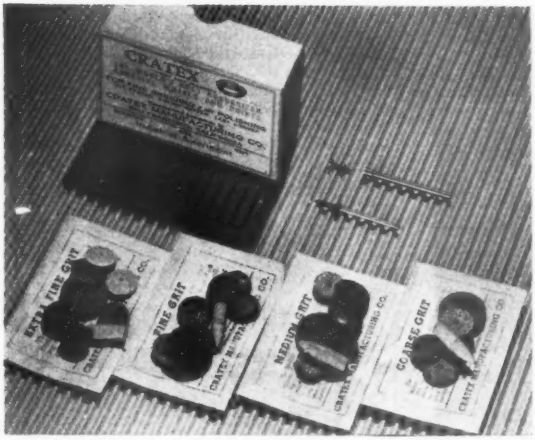
sizes. Detailed information may be had by writing ROSS OPERATING VALVE CO., Dept. 8-89, Detroit 10, Mich., or use INFORM-A-GRAM Key No. 889-Q.

GRINDING EFFICIENCY IS MAINTAINED throughout the grinding wheel life on re-



designed Model No. 30 Multiple Speed Snagging Grinder, available for 18" to 30" wheels. Literature on this unit will multiple V-belt

CRATEX Soft Rubberized Abrasives



WHEELS POINTS

Assortment No. 774

$1.50

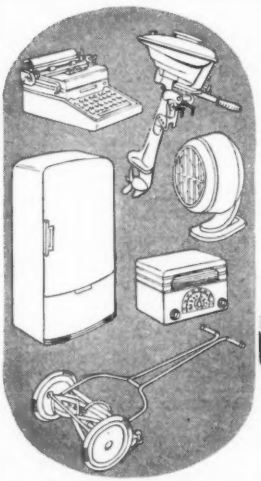
A Big Value

This is a standard assortment to get industrials acquainted with CRATEX products. Soft rubberized abrasive polishing wheels which have no superior.

At Tool and Supply Dealers

ASK FOR CATALOG

CRATEX MANUFACTURING CO., 95 Natoma St., San Francisco, Calif.



Save

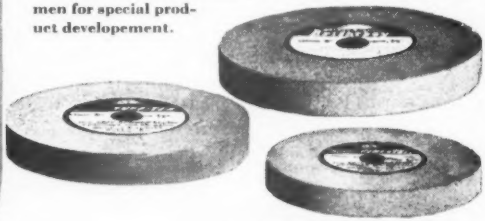
BURRING, FINISHING, POLISHING Operations

in the precision manufacture of modern products in all metals and plastics. Resilient rubber and the abrasive in

Brightboy

work together for new and faster finishing methods, improved products.

Catalogs and prices from your dealer. Brightboy service men for special product developement.



BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark 7, N. J.

drive can be obtained from THE STANDARD ELECTRICAL TOOL CO., Dept. 4-70, Cincinnati 4, Ohio, or use INFORM-A-GRAM Key No. 470-Q.

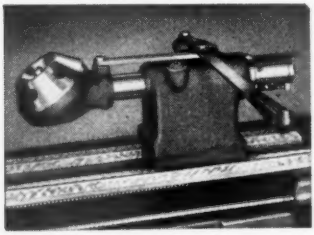
CONSISTENT PERFORMANCE AND GREATER DURABILITY from thermally strain-free assembly is produced by tools having clamped-on, advanceable Kennametal tips with offset and straight shanks. Tips of different grades

can be interchanged in same shank for machining different types of metals. Particulars on these tips for lighter machining jobs are given in a catalog supplement from KENNAMETAL, INC., Dept. 33, Latrobe, Pa., or use INFORM-A-GRAM Key No. 33-Q.

STAMPING, MARKING, PUNCHING, CRIMPING, and RIVETING operations can be performed on a new compact 4-ton bench punch

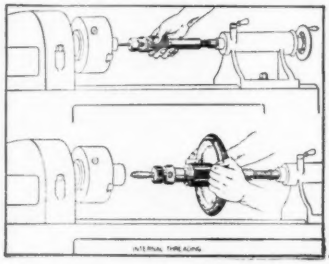
press, as well as regular punch press operations, for which it was designed. It is an open back press, which makes it possible for work to be inserted from the front as well as from the sides. Complete information may be obtained from BENCHMASTER MANUFACTURING CO., Dept. 1-69, 2952 West Pico Blvd., Los Angeles 6, Calif., or use INFORM-A-GRAM Key No. 169-Q.

SUCCESSIVE OPERATIONS with 9" South Bend Lathes is efficiently accomplished by mounting a Handlever Turret on the inside ways of the bed in place of the tailstock. Six-station turret head accommodates tools



with 5/8" diameter shanks. Length of cut at each station is regulated; stop mechanism operates automatically with indexing of turret head. Further mechanical data can be obtained by writing to SOUTH BEND LATHE WORKS, Dept. 5-64, 391 East Madison St., South Bend 22, Ind., or use INFORM-A-GRAM Key No. 564-Q.

THREADING AND TAPPING AT HIGH SPEEDS in a lathe is safely permitted by securing the Grip-Slide hand tool in tailstock with tap or die inserted. It is then grasped

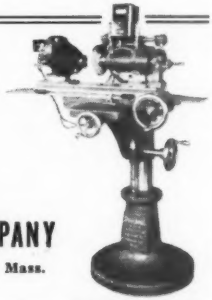


and slid toward the work; after threading is completed, tool is released, halting cutting action, lathe is reversed and tool again gripped for backing off the die or backing out the tap. Information is available from THE THREAD MILLER CORP., Dept. 88, West Orange, N. J., or use INFORM-A-GRAM Key No. H88-Q.

PAYS FOR ITSELF QUICKLY

The moderate cost of this rugged, accurate No. 4U Universal Grinder is quickly forgotten by the shop that has a wide variety of grinding operations to handle. Within its capacity, No. 4U takes them all efficiently in its stride: plain tool and cutter jobs, cylindrical grinding, internal grinding, light or heavy.

Bulletin No. 4 gives complete specifications. Write for your copy today.



Better Because It's Built Better

PRODUCTION MACHINE COMPANY

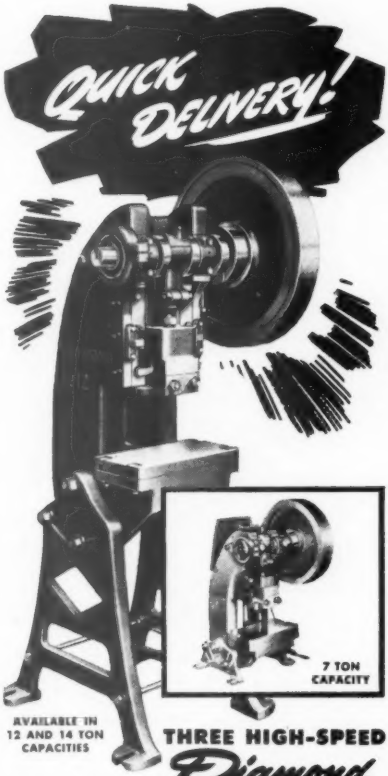
Dept. TD, Greenfield, Mass.

GIVE ME A LUFKIN TAPE WITH THE CHROME WHITE LINE THAT IS DURABLE
CHROME CLAD
THE LUFKIN RULE CO.
CHROME PLATED STEEL LINE WILL NOT CRACK, CHIP, OR PEEL
JET BLACK MARKINGS ON CHROME WHITE SURFACE -- EASY TO READ
LUFKIN

Write for free catalog

THE LUFKIN RULE CO.

SAGINAW, MICHIGAN, New York City



AVAILABLE IN 12 AND 14 TON CAPACITIES

THREE HIGH-SPEED *Diamond* PUNCH PRESSES

In 7, 12 and 14 Ton Capacities

See our booth number H-246 at the National Metal Exposition at Atlantic City from November 18-26.

INCLINABLE, open-back type for all high-speed punching, stamping, forming, riveting and similar operations. Sturdiest, heavy duty type construction. Many advanced features. Fast, safe operation.

QUICK SPECIFICATIONS

MODEL	Standard Stroke	Shut Die Height*	Frame Opening	Flywheel Speed
7 Ton	1"	5½"	5½"	185 Max.
12 Ton	1½"	7¼"	6½"	150 Max.
14 Ton	2"	9"	6½"	150 Max.

*(Ram to bolster plate)

Longer strokes available. Write for circulars!

DIAMOND DTCO

DIAMOND TOOL COMPANY

DEPT. G, 3429 E. OLYMPIC BLVD.

LOS ANGELES 23, CALIF.

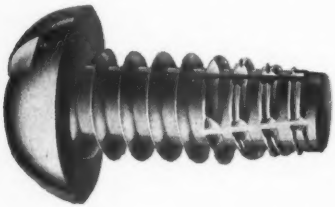
Manufacturers of the DIAMOND Line of Precision Machine Tools and Accessories

PROGRESS ON PARADE

PRECISE DIMENSIONAL INSPECTION OF NICHOLSON FILES is a practical adaptation of a regular model Federal Dial Indicator. The operator can see on the indicator dial whether file width dimension is plus or minus within or outside of tolerance. The highest possible standards of uniformity and dimensional accuracy are made possible by use of this gage manufactured by FEDERAL PRODUCTS CORPORATION, Dept. 4, 1144 Eddy St.,

Providence, R. I. Information is available from the company or use INFORM-A-GRAM Key No. 4-Q.

COMPARATIVELY THIN SECTIONS AND BOSSES, in friable and brittle plastics, can be fastened with the P-K Type "F-Z" Self-Tapping

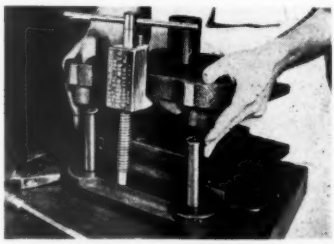


Screw. Cutting pressure is evenly distributed, preventing localized pressure and cracking. Coarse threads eliminate binding and offer greater resistance to stripping out of the material. These advantages eliminate necessity of inserts. Literature is available from PARKER-KALON CORPORATION, Dept. 4-23, 200 Varick St., New York 14, N. Y., or use INFORM-A-GRAM Key No. 423-Q.

ON-THE-SPOT DIE CASTING is made available for industry with the development of a high speed production die casting machine

that costs no more than a bandsaw or a small engine lathe and uses prefabricated die sets. Die casting, the economical short cut between raw metal and finished parts, may now be done in any machine shop with the DCMT Die Caster. Runs as small as 250 parts are now economical, while production speeds of 600 shots an hour may be reached. Detailed information and specifications will be sent on request from DCMT SALES CORP., Dept. 48, 401 Broadway, New York 13, N. Y., or use INFORM-A-GRAM Key No. 148-Q.

DIE SETS ARE SEPARATED EASIER, FASTER AND BETTER with the Persson Safety Die Jack, precision built for easy screw action. Applied to the punch holder in a few seconds, it en-



Mac-it ALLOY STEEL SCREWS

GREATER STRENGTH
where you want it, with
HOLLOW SET SCREWS!

Mac-it Hollow Set Screws will solve your toughest holding-down problems where flush surfaces, compact construction and a neat appearance are factors. *All* Mac-it screws are heat-treated and accurately made with die-cut threads. Whatever your needs, let the *complete* Mac-it line serve you. Sold through recognized distributors from coast to coast and in Canada.

DISTRIBUTED NATIONALLY BY
STRONG, CARLISLE & HAMMOND COMPANY
CLEVELAND 13, OHIO
MANUFACTURED BY
MAC-IT PARTS COMPANY LANCASTER PA

Hundreds of Industrial Plants have

CUT GAGE COSTS

with **SCHNACKE *Adjustable***

FLUSH PIN GAGE

With this new adjustable gage, you can have an accurate Flush Pin Depth Gage quickly and save time and money. Serves many varied gaging purposes in production and inspection. Set consists of 3 interchangeable depth rods (1"—2"—3") and 1" diameter sliding anvil, adjustable to required depth. Sliding tolerance feelers at the top are set with micrometer screw from plus or minus .000 to .200. Locks firmly. Standard set applicable to any decimal dimension up to 3.00".

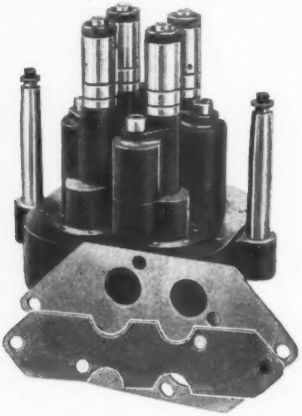
Special anvils and longer rods are also available. Write for descriptive circular.

SCHNACKE, INC.

1016 E. Columbia St. Evansville, Ind.

ables the operator to elevate the punch holder, surely and positively, to any height required, and lower it in the same manner. Positive adjustment of the jack screw is another feature. Write PERSSON MFG. COMPANY, Dept. 62, 2 Henry St., Bloomfield, N. J., or use INFORM-A-GRAM Key No. J62-Q.

AN INFINITE RANGE OF HOLE PATTERNS is permitted with the Wisconsin Quick Change Drill Head, a production tool designed to promote efficiency, economy and precision



in long run, multiple drilling operations. Its extreme flexibility permits quick changes in setup for an endless variety of bolt circles or rectangular hole-patterns. A set of templates is furnished with each to fit the users requirements. Write STRUTZ & MEAD, INC., Dept. 65, 1225 N. Water St., Milwaukee 2, Wis., or use INFORM-A-GRAM Key No. J65-Q.

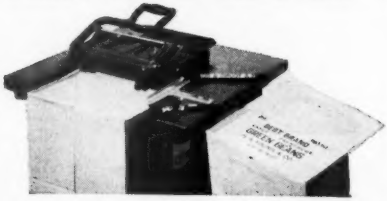
RAPID PRODUCTION OF ANNULAR AND CYLINDRICAL FORMS, such as circular form

tools, crusher rolls, ball-bearing seals, seaming rolls, shift grooves in automotive and farm implement transmission gears, and other similar forms of intricate and precise profile, is achieved with the Sheffield Precision Annular Form Grinder which utilizes the "Crushtrue" principle of wheel dressing. Literature is offered by the SHEFFIELD CORPORATION, Dept. 24, 721 Springfield St., Dayton, Ohio, or use INFORM-A-GRAM Key No. 24-Q.

A RANGE OF ELEVATION, UNOBTAINABLE WITH STANDARD CONSTRUCTION, is possible with the Lyon-Raymond Hydraulic Elevating Table, utilizing a telescopic

cylinder. In handling of dies, jigs and fixtures, the table permits leveling with press beds and storage racks, allowing for easy transfer. The elevation range is valuable when table is used in assembly operations and as a transfer member in a conveyor line. Write LYON-RAYMOND CORPORATION, Dept. 3-74, 2862 Madison St., Greene, N. Y., or use INFORM-A-GRAM Key No. 374-Q.

IMPRINTING OF CORRUGATED CARTONS, WOODEN BOXES OR BARREL TOPS is



achieved with the Markomatic Industrial Printer. This unit replaces stencil operation, improves appearance of the case, and is

DO YOU SHAPE SHEET METAL?

Now Available
KROMITE No. 3

HERE'S A PRESS BRAKE STEEL TO SAVE YOU TIME AND MONEY

Pre-hardened • No heat treatment required

Extremely High Tensile Strength — Free Machining — Will Not Deform On Stock To ¼" — Just Shape And Use.

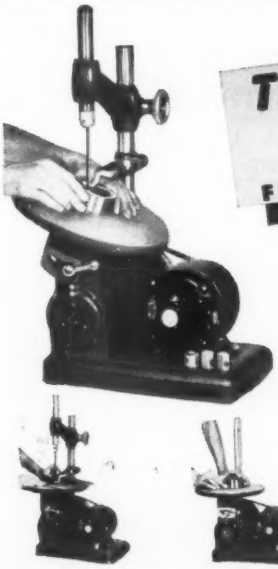
ALL SIZES OF FLATS AND SQUARES AVAILABLE FOR IMMEDIATE DELIVERY

An Associated Steel Research Man Will Call At Your Request

ASSOCIATED STEEL COMPANY

4547 HOUGH AVE. • CLEVELAND 3, OHIO

ALTO • KROMITE • MOLEX TOOL STEELS



Sawing

Stoning

TRIPLE PURPOSE MACHINE

FILES . . . SAWS . . . STONES

ILLINOIS DIE FILING MACHINE

An accurate, smoothly-operating machine that files, saws and stones the most intricate die shapes . . . eliminates tedious hand operations . . . reduces costs. It is quality-built for long, trouble-free service . . . hardened and ground shafts running in bronze bushings minimize wear. The holding chuck and clamping device provide perfect file alignment.

Write for descriptive literature.

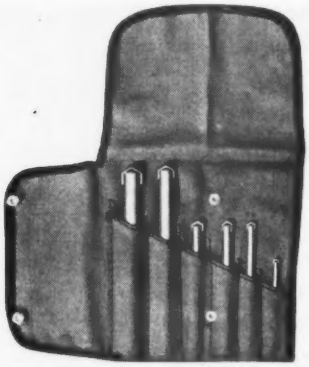
ILLINOIS TOOL WORKS

2501 N. Keeler Ave. • Chicago 39, Ill.

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

easier read. A manual machine, it handles several carton sizes, and has interchangeable type at low operating cost. Further particulars are offered by ADOLPH GOTTSCHO, INC., Dept. 44, 1 Hudson St., New York, N. Y., or use INFORM-A-GRAM Key No. 44-Q.

DRILLING FOUR TIMES FASTER and fifty times longer than with drills of hardest steel is accomplished with Carboloy Masonry Drills



in concrete, brick, tile, marble, slate, plastics, etc. A solid round shank without flutes gives greater strength and support to carbide cutting tip; they can be used in any rotary portable drill, hand brace, or drill press. Literature is available from CARBOLOY COMPANY, INC., Dept. 82, 11109 E. 8 Mile Blvd., Detroit 32, Mich., or use INFORM-A-GRAM Key No. 82-Q.

ANY KIND OF MATERIAL CAN BE GROUND with the DoALL All-Purpose Grinding Wheel which works equally well for heavy, fast roughing cuts and fine finishing. It can be used on all types of grinding machines without alteration to the machine. Production

three to ten times faster than with conventional wheels is easily obtained. Information will be supplied by THE DoALL COMPANY, Dept. 6-96, 1301 Washington Ave. South, Minneapolis 4, Minn., or use INFORM-A-GRAM Key No. 696-Q.

NECESSARY REFINEMENTS FOR ACCURACY AND LONG LIFE are combined with great strength and power for heavy milling operations in Model M-30, a low-cost, high quality Diamond Mill. It features high production for a wide range of milling applications, and is rigidly constructed for heavy cuts in all metals, without stalling or chat-

tering. Additional information is offered by DIAMOND MACHINE TOOL COMPANY, Dept. 2-68, 3429 East Olympic Blvd., Los Angeles 23, Calif., or use INFORM-A-GRAM Key No. 268-Q.

CORRECT BLADE TENSION IS SET AND MAINTAINED on power hack saws with the "Tensiometer" easily attached to the blade

KEYWAYS
IN QUANTITIES
10 Times Faster

WITH THE
GLENNY....
adjustable-expansion
***Push* BROACH**

Accuracy of ± .0005

Send for Bulletin 9

Dept. 5C
East Shore Mach. Prod. Co.
835 East 140th Street - Cleveland 10, Ohio, U.S.A.

***Fast* Accurate Measurements**
with the *NEW* AMIC
QUICK ACTION
VERNIER CALIPER

Stainless Steel

THE PERFECT TOOL for machine shop, toolroom, inspection control, aircraft maintenance, etc.

A flick of the thumb and you've got your external and internal dimensions. Knife-edged, hardened jaws provide exact thread measurements. A depth gage blade gives speedy depth measurements. Made of stainless steel; packed in a sturdy leather case. Scientifically engineered, painstakingly machined and American made, the **AMIC** Quick Action Caliper is a tool without a rival.

Size 6". Graduation 1/40", vernier reading .001, catalog No. 21; graduation 1/40" and full mm, vernier reading .001 and 1/10 mm, catalog No. 22. Also AMIC Precision Vernier Calipers, Height Gages, Depth Gages, Pocket Calipers, Comparators, Precision Graduated Metal Scales.

Write for FREE Booklet A and price list or telephone PEnnsylvania 6-0687

AMERICAN MEASURING INSTRUMENTS CORP.
240 WEST 40th ST. • NEW YORK 18, N. Y.

3 NEW *Featherweight* KIPP AIR GRINDERS

MODEL JA
(Turbine Type Tool)—Takes Wheels Up To ⅜", Speed 50000 RPM, Collet ⅛", Weight 12 oz. Overall Length 6¾".

$33.25 IN U.S.A.

MODEL TT
(Turbine Type Tool)—Takes Wheels Up To 1¼", Speed 30000 RPM, Collet 15/64", Weight 2 lbs., Overall Length 9"

$44.50 IN U.S.A.

MODEL PVT
(Vane Type Tool) — A Power Tool For The Heavier Jobs Taking Wheels Up To 2½", Speed 10000 RPM, Collet 15/64", Weight 2 lbs. 4 oz., Overall Length 9".

$75.50 IN U.S.A.

Order Now!

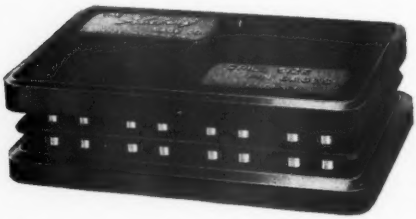
You now have your choice of three Featherweight Kipp Air Grinders as illustrated above. All three are available for immediate delivery and priced extremely low. Order today.

MADISON-KIPP CORPORATION
212 Waubesa St., Madison 4, Wis.

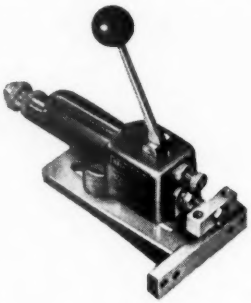
holder of the machine. It is a small cylinder, enclosing a strong, calibrated spiral spring and acts as a shock absorber for the blade. It improves accuracy of cut, maintains substantially constant tension, and minimizes blade breakage. For further information, write MILLERS FALLS COMPANY, Dept. 59, Greenfield, Mass., or use INFORM-A-GRAM Key No. J59-Q.

USED IN FABRICATION OF SMALL PARTS of metal, wood or plastic items and equipment, the Dumore lightweight, High Speed Bench Drill takes ⅛" drills and smaller. Permanently mounted to a bench or portable, it only weighs 15 pounds. In operation, the table is elevated to the drill through a hand control geared to the table. A release from THE DUMORE COMPANY, Dept. 5-61, Racine, Wis., completely describes the unit, or use INFORM-A-GRAM Key No. 561-Q.

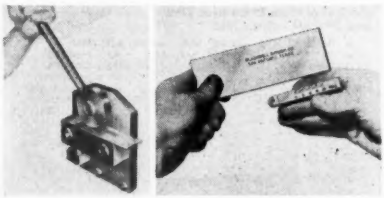
ACCURACY AT MODERATE PRICE warrants large scale use of Horberg Drill Size Pin Gages in tool and inspection departments. Complete sets of either numbered, lettered or fraction type drill size pin gages, in a handy case, have been introduced. For further information write for Bulletin B from THE HORBERG GAGE COMPANY, Dept. 60, 19 Staples St., Bridgeport 1, Conn., or use INFORM-A-GRAM Key No. J60-Q.

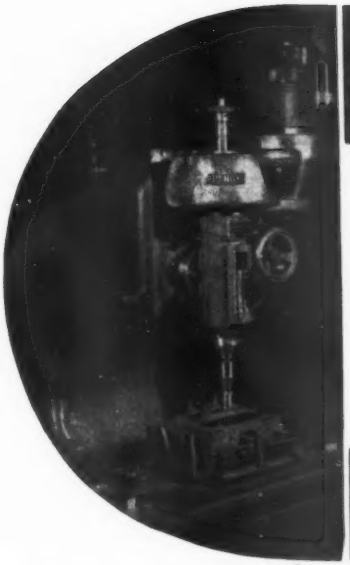


THREAD CUTTING IS SPEEDED UP with the Lawrenz Thread Faster that retracts the tool bit from work at the same point each time a thread is cut or chased on a lathe. The unit is recommended for production runs too small for automatic equipment, on jobs where threads must run up to a shoulder, and in all metals or plastics. Literature is available from PEERLESS TOOL & ENGINEERING CO., Dept. 61, 1139 N. Kilbourn, Chicago 51, Ill., or use INFORM-A-GRAM Key No. J61-Q.



A SIMPLE, LESS EXPENSIVE MEANS OF MARKING FLAT PARTS is offered by the Acromark No. 920, Hand-Operated, Bench Type Marking Machine, that also marks round parts by a slight change in construction. Four lines of print can be sunk into untempered steel, stainless steel or other material, and the part moves freely through the marking process. Further details and information are available from THE ACROMARK COMPANY, Dept. 6-36, 5-15 Morrell St., Elizabeth, N. J. or use INFORM-A-GRAM Key No. 636-Q.





MILLING - DRILLING - BORING
ATTACHMENT for Heavy Duty Operations

Photo shows Rusnok head used to convert an old type milling machine into high speed, versatile, productive equipment. Uses many types of cutters on a wide range of work. Easily mounted—tilts to any angle. Large size spindle (No. 9 B & S taper). Takes 1/16" to 3/4" end mills. Large quill with 4" travel, counter balanced, hardened and ground. Six speeds 250 to 3000 RPM. Lever and worm feeds. 1½ h.p. motor. Specially engineered by RUSNOK to meet modern demands for high speed, high precision, heavy duty end mill operations.

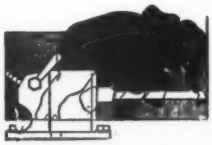
Prompt delivery

Write for illustrated Circular and Prices

RUSNOK TOOL WORKS
4840 WEST NORTH AVE. CHICAGO 39, ILL.

Cut Costs with
MEAD
MIDGET
AIR
CLAMPS

Horizontal and Vertical!



Both models deliver 80 lbs. pressure on a line pressure of 100 lbs. They'll save countless man-hours in assembly operations involving welding, riveting, bolting, etc. *Advantages over mechanical clamps:* 1. Any number can be operated by single master valve. 2. Easily installed in cramped corners. 3. Equal ram pressure at any stroke point. Send for new Mead AIR POWER Catalog, describing our line of Air Clamps, Air Vises, Air Presses, Work Feeders, Valves, Controls, etc.

MEAD SPECIALTIES COMPANY
4114 NORTH KNOX AVENUE • DEPT. HA-106 • CHICAGO 41, ILL.

PRECISION REID SURFACE GRINDERS

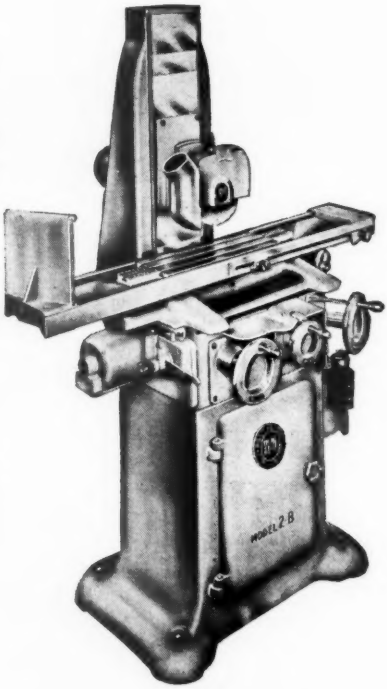
"for CLOSE TOLERANCE use a REID"

May we suggest

that you check your surface grinding department? Are your machines doing PRECISION work in an efficient and time-saving manner? It's sound reasoning to have this department in "top" condition. We want you to know that there's a Reid Distributor located convenient to you and he'll gladly give any information you may require on

REID PRECISION SURFACE GRINDERS

You'll find this machine capable of bringing your grinding department up to "top" performance on your PRECISION work at reduced operating time and expense.



Illustrated is the REID Model 2-B All-Electric Power-Feed.

The Reid Model 2-C Hand-Feed also is an exceptional machine for tool, gage, die and certain production grinding.

MACHINES EQUIPPED FOR WET GRINDING IF NECESSARY.

EXCELLENT DELIVERIES

Distributors conveniently located in all sections

WRITE DEPT. F
For Illustrated Bulletin and Prices.

REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

PUBLICATION PREVIEWS

Keep Informed! CATALOGS • BULLETINS • SPECIFICATIONS

Use our postage-free Inform-a-Gram for your request

TOOLING FOR PRODUCTION is presented in a new catalog currently announced by Eclipse Counterbore Co. Cemented tungsten carbide tipped cutters, special holders and drives (both radial and pin drive), balanced

drive inverted spot facers, Welch plug cutters, core drills and complete counterbore sets are described in detail. A copy may be secured by addressing requests (including name, title and company) to the Sales Department (31), ECLIPSE COUNTERBORE CO., 1600 Bonner Ave., Detroit 20 (Ferndale), Mich., or use INFORM-A-GRAM Key No. J31-Q.

FINISHING CONTOURS, HARD-TO-REACH RECESSES, AND SURFACES are accomplished with the Sand-O-Flex, a multi-purpose, brush-type sanding and finishing device. It is designed to finish all types of materials and has often replaced sandblasting. Literature is available from SAND-O-FLEX CORPORATION, Dept. 80, 4373 Melrose Ave., Los Angeles 27, Calif., or use INFORM-A-GRAM Key No. D80-Q.

FLEXIBLE ADJUSTABILITY PLUS ECONOMY AND DURABILITY make Drive-All Selective Speed Transmissions practical for drill presses, lathes, milling machines, shapers, automatics, and all types of machines. Mounting brackets are extremely easy to install. For data write DRIVE-ALL MANUFACTURING CO., Dept. 5-70, 3400 Conner Ave., Detroit 14, Mich., or use INFORM-A-GRAM Key No. 570-Q.

BUILT TO RIGID HIGH STANDARDS FOR QUALITY PRECISION PRODUCTION, Diamond No. 12 and 14 Power Punch Presses are compact machine tools, with 12 and 14 ton capacity respectively. Inclinable and open-backed, the units require little floor space. Literature may be obtained from DIAMOND MACHINE TOOL CO., Dept. 2-68, 3429 East Olympic Blvd., Los Angeles 23, Calif., or use INFORM-A-GRAM Key No. 268-Q.

EFFICIENT PERFORMANCE IN DIFFICULT AND INACCESSIBLE PLACES is assured with High Speed Steel Hand Cut Rotary Files and Burs, power tools used in flexible or stationary shaft machines, portable electric or air tools. Finishing operations, die sinking and metal pattern making are operations performed. Literature is available from M. A. FORD MFG. CO., INC., Dept. 42, 732 W. First St., Davenport, Iowa, or use INFORM-A-GRAM Key No. A42-Q.

RIGID CONTROL OF ACCURATE MACHINING OPERATIONS is attained with the Hartford Super-Spacer, a time-tested spacing device, adaptable for milling, drilling, grinding, jig boring and slotting. Setup is easy and quick; indexing rapid and positive. Bulletin No. S-101 from THE HARTFORD SPECIAL MACHINERY CO., Dept. 5-75, Hartford, Conn., gives details, or use INFORM-A-GRAM Key No. 575-Q.

PRECISION GAGING OF INTERNAL CYLINDRICAL WORK to a fraction of .0001" is achieved by the Comtorgage, a highly accurate and easily operated measuring instrument. The Comparator positively and automatically compares the work with the Master Reference Standard. Bulletin No. 30 gives details from the COMTOR COMPANY, Dept. 3, Waltham, Mass., or use INFORM-A-GRAM Key No. A3-Q.

PUBLICATION PREVIEWS

ADDED LUBRICATING PERFORMANCE IS REALIZED by mixing Motor Mica Anti-Friction Compound with lubricants, producing a lubricating film on moving parts that prevents metal-to-metal contact. It cools hot bearings and reduces friction load in punch press, machine shop and die casting operations. Write SCIENTIFIC LUBRICANTS CO., Dept. 4-56, 3469 N. Clark St., Chicago 13, Ill., or use INFORM-A-GRAM Key No. 456-Q.

UP-TO-DATE DEVELOPMENTS, MATERIALS, AND HEAT TREATMENT are embodied in "National" Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs and Metal Cutting Tools. Handbook Catalog 16, from NATIONAL TWIST DRILL & TOOL CO., Dept. 91, Rochester, Mich., gives information and data on the tools listed, plus other standard and special metal cutting tools, or use INFORM-A-GRAM Key No. C91-Q.

HAND BURRING METHODS ARE ELIMINATED and holes deburred in a speedy machine operation incorporating the Nobur Tool. Held in any machine spindle, it quickly deburrs even multi-walled parts and curved surfaces, smoothly and accurately. A booklet from NOBUR MANUFACTURING CO., Dept 1-64, 910 N. Orange Drive, Los Angeles, Calif., tells how it's done, or use INFORM-A-GRAM Key No. 164-Q.

IN THE TIME IT TAKES TO FLIP A LEVER, work fastened with Knu-Vise devices can be released, thereby speeding up production. This method of mounting and releasing is due to a unique toggle-action principle, also found in the Vise Wrenches which act as work holders and wrenches. Write for information from KNU-VISE, INCORPORATED, 2200 Eighth St., Dept. 6-48, Detroit 16, Mich., or use INFORM-A-GRAM Key No. 649-Q.

EFFICIENT PERFORMANCE AND OUTSTANDING SERVICE are achieved by Aro Lubricating Equipment and Pneumatic Tools, assembled from accurate precision built parts. Compact design and low installation and operating cost make understandable their big demand. Write THE ARO EQUIPMENT CORP., Dept. 1-95, Bryan, Ohio, for information, or use INFORM-A-GRAM Key No. 195-Q.

STABILITY, MAXIMUM EFFICIENCY AND ECONOMY OF OPERATION are insured with Cooley Electric Furnaces for industrial and laboratory uses. Those units heat-treat small parts quickly and can be used as auxiliary equipment to larger furnaces. COOLEY ELECTRIC MANUFACTURING CORP., Dept. 5-87, 38 S. Shelby St., Indianapolis, Ind., offers Bulletin No. 56, or use INFORM-A-GRAM Key No. 587-Q.

BETTER WHEEL DRESSING is assured by three separate drag angles provided by automatic, self-leveling action of the Booth 3-Angle Turret Diamond Holder. Three sharp cutting points cleanly and accurately dress the wheel and reduce operations. A catalog sheet is offered by THE DIAMOND TOOL CO., Dept. 6-33, 938 E. 41st Street, Chicago, Ill., or use INFORM-A-GRAM Key No. 633-Q.

DEPENDABLE PACKAGED POWER AND SERVICE, founded on design and precision built methods, are features of Hydro-Power hydraulic high pressure pumps, valves, controls, boosters and packaged hydraulic power units for hydraulic machine applications. Bulletin No. 460 from HYDRO-POWER, INC., Dept. 50, Springfield, Ohio, explains the complete line, or use INFORM-A-GRAM Key No. 150-Q.

SPEED IS RECORDED, INDICATED AND AUTOMATICALLY CONTROLLED with Bristol Tachometer Recorders and Indicators, applied to paper machines, turbines and generators, conveyors, and blowing engine of blast furnaces. Full data is offered in Bulletin S1400 from THE BRISTOL CO., Dept. 29 , Waterbury 91, Conn., or use INFORM-A-GRAM Key No. F29-Q.

PROTECTION IS GIVEN TO THE FINGERS AND THUMBS by Steel-Grip Finger Guards in burring, grinding, buffing, sanding, assembly, machine and punch press operations. Made of flexible sturdy leather with porous woven elastic back, they protect the sides and front of the fingers. Inquire from INDUSTRIAL GLOVES CO., Dept. 96, 700 Garfield Blvd., Danville, Ill., or use INFORM-A-GRAM Key No. E96-Q.

Need Specialty Steel...*FAST?*

"CALL CRUCIBLE"

Here's How Crucible Warehouse Service can fill your needs—*save you time and money*

ALL OF THE STEEL you get from a Crucible Warehouse is Crucible's own make. This means that every item of high-speed—tool—die—stainless—alloy—machinery—or special purpose steel is backed by the Crucible mills, which guarantees adequate stocks of uniformly top quality in every warehouse.

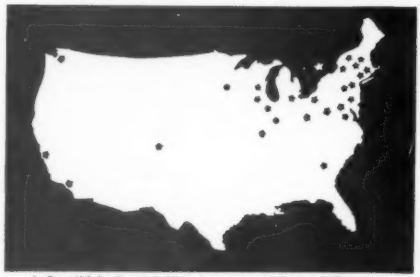
Convenient and Time-Saving

The recent Harvard study pointed up the need for better control of steel buying as an important factor in control of production costs. Are you taking full advantage of centralized buying? Crucible's full-range warehouse service may make it possible for you to carry a lower steel inventory. Certainly it involves less paper work in checking and accounting—only one handling in the receiving department—requires no additional phone calls or orders to other suppliers.

Service Engineers Available

Crucible's Advisory Service, set up at each warehouse, brings you the services of experienced steel men. Your Crucible representative can give you sound help in selecting the *right* production steel and the *correct* tool or die steel with which to fabricate it. He can advise you on their most efficient use. In addition, mill metallurgists are available for consultation on special problems.

Crucible's Warehouses handle only Crucible steels . . . and the men who make Crucible steels know what each type is best for. Call on your nearest warehouse for expert advice.



★ Crucible's Branch Warehouses and Sales Offices

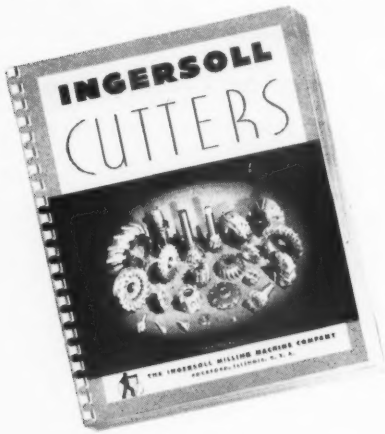
Consult Telephone Directory or Thomas' Register for Nearest Office

CRUCIBLE STEEL COMPANY of America

High Speed • Tool • Stainless • Alloy • Machinery Special Purpose Steels

CHRYSLER BUILDING • 405 LEXINGTON AVE. • NEW YORK 17, N. Y.

A WIDE VARIETY OF MATERIALS can be cut with Ingersoll Standard Inserted Blade Cutters for milling and boring machines. Some types are suited for steel, others for cast iron, and many for general purpose. Their fields



of application are so numerous, they overlap. Cutter Catalog No. 55 from THE INGERSOLL MILLING MACHINE CO., Dept. 70, Rockford, Ill., gives data or use INFORM-A-GRAM Key No. C70-Q.

INTRICATE CUTTING IS EFFICIENTLY HANDLED by the "B-3" Beverly Throatless Shear, that cuts without distorting, scratching or marring the metal. Special design makes possible turning of metal to any position while cutting. A circular from THE BEVERLY SHEAR MFG. CO., Dept. 8, 3004 W. 111th St., Chicago 43, Ill., gives description, or use INFORM-A-GRAM Key No. G8-Q.

FINE GRINDING AND POLISHING is accomplished with Cratex Rubberized Abrasive Wheels and Points that cut faster, last longer and polish better on all metals. Their primary ingredients are rubber, abrasive grains and polishing substances, scientifically blended. Accurate up-to-the-minute information is available from CRATEX MANUFACTURING CO., Dept. 21, 81 Natoma St., San Francisco, Calif., or use INFORM-A-GRAM Key No. E21-Q.

PRODUCING DIE CASTINGS in small runs as low as 250 parts has been made possible through the development of the DCMT Die Caster. Because of the high speed of operation, 500 to 700 shots per hour, it is possible to use single impression dies instead of the multi-impression type to reach a high rate of production. This machine is described in literature available from the DCMT SALES CORP., Dept. 48, 401 Broadway, New York 13, N. Y., or use INFORM-A-GRAM Key No. J48.5-Q.

MEASURING AND RECORDING SURFACE ROUGHNESS by means of two new accessories to the Profilometer are described in new literature recently released. The AW Tracer will measure surfaces on nearly all OD's and ID's from ¼" up, also on both external and internal tapered surfaces. The Profilometer Reading Recorder provides a continuous chart record of the Profilometer reading. Copies of these two leaflets are available from PHYSICISTS RESEARCH CO., Dept. 9, Ann Arbor, Mich., or use INFORM-A-GRAM Key No. 773.5-Q.

DRILLING, SCREW DRIVING, NUT SETTING, ROTARY FILING AND DIE GRINDING by pneumatic power is illustrated and demonstrated in a bulletin, entitled "Ideal Machinery Products." Dust Collectors, Live Centers, Balancing Ways and other machine products are also listed. Copies are obtainable by writing IDEAL INDUSTRIES INC., Dept. 30, 1296 Park Ave., Sycamore, Ill., or use INFORM-A-GRAM Key No. H30.5-Q.

PRODUCTION IS INCREASED AND QUALITY IMPROVED by Pneumatic Operating Equipment for Kick Presses. The air engine does the work; it is impossible for operator to trip the press while hands are in danger. The automotive, explosive and production tool fields find these presses indispensable. For information write NATIONAL PNEUMATIC CO., Dept. 71, Rahway, N. J., or use INFORM-A-GRAM Key No. G71-Q.

CHECKING ALL TYPES OF SMALL AND LONG BORES TO CLOSE LIMITS is the purpose of the Sheffield Universal Precisionaire Instrument, an air-flow gage that measures through air velocity instead of pressure. External or internal dimensions can be checked, eccentricity, or thickness, etc. THE SHEFFIELD CORP., Dept. 24, Dayton 1, Ohio, will send Bulletin No. 600-1-45, or use INFORM-A-GRAM Key No. 24-Q.

MAKERS AND USERS OF GAGES find facts prove Graph-Mo Steel helps build gages that meet every industry's requirements. Free-machining and non-scuffing, with uniform response to heat treatment, Graph-Mo Steel has stable structure and resists wear. Write STEEL AND TUBE DIV., THE TIMKEN ROLLER BEARING CO., Dept. 5-73, Canton 6, Ohio, or use INFORM-A-GRAM Key No. 573-Q.

COMPLETE GRINDING SERVICE by the latest and most economical methods is offered by Universal Grinding Co. Descriptive literature "An Old Grind" describes the types of machines on which any form work from needles to multi-diameter shafts up to twelve

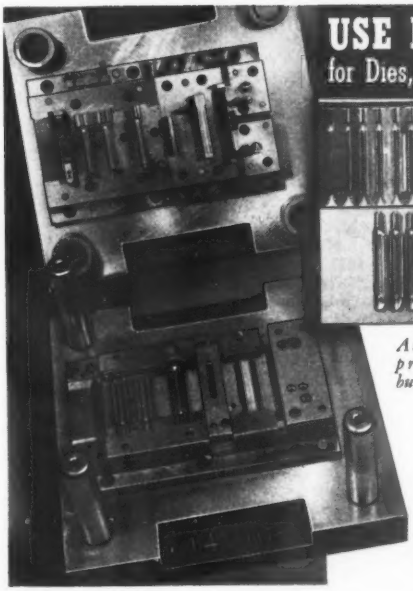
CRITERION *Boring Heads*

Original Accuracy *Maintained*

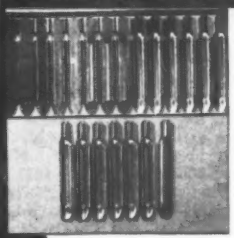
Noted for maintaining original accuracy over a longer period. Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

Lead Screw ground from solid AFTER hardening.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA



USE FEDERAL FACILITIES
for Dies, Special Tools, Jigs, Fixtures, Molds



An eight-station progressive die built by FEDERAL.

- FEDERAL equipment is up-to-the minute.
- Our technique is modern—
- Our personnel is trained to meet your most exacting requirements.
- When you have a tooling problem, write FEDERAL.

FEDERAL TOOL CORPORATION
400 N. Leavitt Street
CHICAGO 12, ILLINOIS

inches long and six inches in diameter can be ground by the centerless method. For copies write UNIVERSAL GRINDING CO., Dept. 55, 2476 E. 30th St., Cleveland 15, Ohio, or use INFORM-A-GRAM Key No. J55-Q.

BORING OPERATIONS are facilitated by the new adjustable boring bar produced by Pump & Products Co. The tool is compact, rugged, easily adjusted, and precision made. Literature describing this tool will be sent on request from PUMP & PRODUCTS CO., Dept. 54, Tool Division, 6715 Detroit Ave., Cleveland, Ohio, or use INFORM-A-GRAM Key No. J54-Q.

CLEANING MISCELLANEOUS STAMPINGS, bearing races after lapping, and numerous other products is described in literature by Ransohoff. The machines utilize the wet method, thereby eliminating the necessity for dust collecting systems. This literature will be sent on request from N. RANSOHOFF, INC., Dept. 56, Township & Big Four RR, Cincinnati 16, Ohio, or use INFORM-A-GRAM Key No. J56-Q.

INDIVIDUALLY MOTOR-OPERATED TOOL SLIDES enabling exceptional versatility of machining setups are part of the equipment of the new Uni-Matic lathe illustrated and described in new literature by Monarch. Electrical features and timing devices for efficient machining of parts at high speed are also described. Bulletin No. 1701 will be sent upon request by THE MONARCH MACHINE TOOL COMPANY, Dept. 5-38, Sidney, Ohio, or use INFORM-A-GRAM Key No. 538-Q.

ENABLING DIRECT PRINT AND BLUE PRINT PAPER TO KEEP ITS PROPERTIES over long periods of time, a new coating process rendering more accurate reproduction of drawings has been developed by THE WING-VALENTINE COMPANY, 7120 North Clark Street. For further information write to them, Dept. 17, Chicago 26, Ill., or use INFORM-A-GRAM Key No. J17-Q.

INDISPENSABLE FOR HARD-TO-GET-AT DEBURRING, CHAMFERING OR COUNTERSINKING JOBS, the BurrAway Tool gives split-second action, burrs blind holes, and drills and burrs in one pass. It is self-contained, precision built, and constructed for easy disassembly. Specifications may be obtained from HOLE ENGINEERING SERVICE, Dept. 3-20, 13722 Linwood Ave., Detroit 6, Mich., or use INFORM-A-GRAM Key No. 320-Q.

ACCURATE AND UNVARYING CONTROL OF PRESSURE AND CYCLE TIMING with Vickers Hydraulic Controls assure product uniformity and permit minimum product tolerances. These pumps, valves and power units are an important component of modern high-production plastics molding machinery. Literature is available from VICKERS, INC., Dept. 47, 1400 Oakman Blvd., Detroit 32, Mich., or use INFORM-A-GRAM Key No. H47-Q.

TUBULAR AND SOLID BAR STOCK DIAMETERS ARE REDUCED into cylindrical, conical, or "necked" and special shapes in Rotary Swaging Machines, without loss of material. This swaging improves physical characteristics of the metal and increases the wall thickness of tubular stock. STANDARD MACHINERY COMPANY, Dept. 30, Providence 7, R. I., offers Catalog Section SM, or use INFORM-A-GRAM Key No. F30-Q.

FIXTURES AND MACHINE INSTALLATIONS for internal and external broaching operations on the Type "XP" Vertical Pull-Down Broaching Machines are illustrated in literature recently issued. Tool handling is automatic; fluid power and design developments are incorporated. Bulletin 25000 is available from THE OILGEAR COMPANY, Dept. 44, Milwaukee 4, Wis., or use INFORM-A-GRAM Key No. E44-Q.

MAKING IT POSSIBLE TO ELIMINATE DEFLECTION, overlap between clutch and brake, as well as time wasted in manual operation, the new Warco Open Back Inclinable Presses are designed for efficiency and safety. Features include especially welded construction, stress relieved weldments, mechanically interlocked clutch and brake unit, electric push button controls, and an interchangeable die cushion. Write WARREN CITY MANUFACTURING CO., Dept. 93, Warren, Ohio, or use INFORM-A-GRAM Key No. E93-Q.

GREATER ACCURACY AND STABILITY, longer wear life, less weight, and positive identification and adjustment are realized by using the Woodworth Thread Ring Gage, that starts round and stays round with every adjustment. Information on this mathematically correct gage can be obtained from N. A. WOODWORTH CO., Dept. 9-26, 1300 E. Nine Mile Rd., Detroit Mich., or use INFORM-A-GRAM Key No. 926-Q.

CAMSHAFT GEAR PRODUCTION IS GREATLY FACILITATED by using a standard Red Ring Gear Shaving Machine for correcting errors in involute form, tooth spacing, eccentricity, and helix angle. Tooth surface smoothness is also improved. Literature from NATIONAL BROACH AND MACHINE CO., Dept. 39, 5600 St. Jean, Detroit 13, Mich., is available, or use INFORM-A-GRAM Key No. A39-Q.

ADAPTABLE TO JIGS AND FIXTURES FOR EVERY CONCEIVABLE APPLICATION, "PEC" Toggle Clamps do work of expensive individually designed equipment, because of their infinite positions, exclusive, self-adjusting features. Folder No. 7 from PRODUCTS ENGINEERING CO., Dept 1-58, 9045 Wilshire Blvd., Beverly Hills, Calif., explains these features, or use INFORM-A-GRAM Key No. 158-Q.

Miccro
Supreme
LAY-OUT AND IDENTIFICATION DYE

12 COLORS*

For Tool, Die, Pattern or Template layout on metal . . . Quick identification of stock and parts . . . Shows up in sharp relief—dries instantly—easily removed . . . Write for circular.

**Purple shipped unless otherwise specified*

MICHIGAN CHROME & CHEMICAL COMPANY
6340 E. Jefferson Ave. • Detroit 7, Mich.

TIP *Clearance*

Patented
HY-CO CENTER-DRILLS
WILL SAVE FOR YOU, TOO!

Unbelievable savings are reported by every shop using the new, Patented HY-CO Center Drills. Send for proof in booklet—"A Winner 4 to 1." See how "tip clearance" helps prevent center drill breakage; why "HY-CO Center Drills" have no fatigue point; how LINE CONTACT with the Center abolishes out-of-round work. Send card with name and company for booklet to Dept. AD.

HOWARD H. HEINZ, INC.
DETROIT 3 MICHIGAN
PATENT No. 2,403,865

3/16" – 1/8"

Keep track of hole sizes as you bore or grind

Now you can be sure of the *exact* size of trial cuts in bringing a hole up to size during boring or grinding. With a set of Moore *Direct Reading* Leaf Taper Gages, any hole size can be measured in infinite increments from .095" to 1.005". Simply insert the gage in the hole and read its diameter directly from the gage.

Each leaf in the complete set of thirty-six is a separate tool, accurate to .00025". It may be used individually without interference from any other gage. Graduations on each size overlap the next by .010"...enable measuring of counterbored or shouldered holes as well as the bottom of through holes to check for bellmouth or taper. Write today for detailed literature.

MOORE SPECIAL TOOL CO., INC.
726 Union Ave. • Bridgeport 7, Conn.

JIGS & TOOLS

MOORE DIRECT READING LEAF TAPER GAGES

Grobet
ROTARY FILES
HAND CUT — MILLED CUT
GROUND FROM THE SOLID

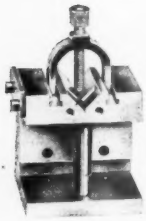
There is a Grobet Rotary File, Cutter, Diesinker's Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc.
Send for Catalog Y. R. illustrating the complete line in full size, speed charts, etc.

Plants: New York · Chicago · Los Angeles

GROBET FILE CO. of AMERICA

421 Canal Street 1812 1943 F. L. GROBET **New York 13, N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES



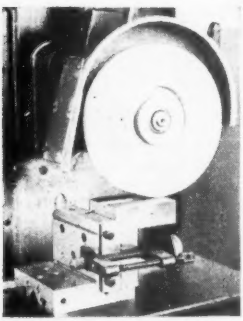
Hold Everything!

Wait till you see the Sensational

LASSY PRECISION V-BLOCK ANGLE IRON

Holds work accurately and firmly

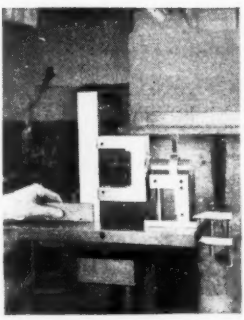
For BORING • GRINDING • INSPECTION



Made of finest steel and artificially aged for stability with surface hardened evenly. All surfaces are ground parallel and square within .0002. This angle iron replaces many special jigs and fixtures and pays for itself in time saved in setting up jobs.

Left: Grinding a fixture square both ways. Diamond is adjustable on angle iron so wheel can be dressed without raising or lowering spindle.

Right: Checking squareness of tool in relation to shank. Base plate of angle iron permits clamping it to surface plate.



Send for folder T-30

LASSY TOOL COMPANY • Plainville, Conn.

INTERCHANGEABILITY

Your KEY to
MASS PRODUCTION
Will Speed up Drilling
and Lower Costs

A. S. A. STANDARD
PRECISION DRILL JIG BUSHINGS

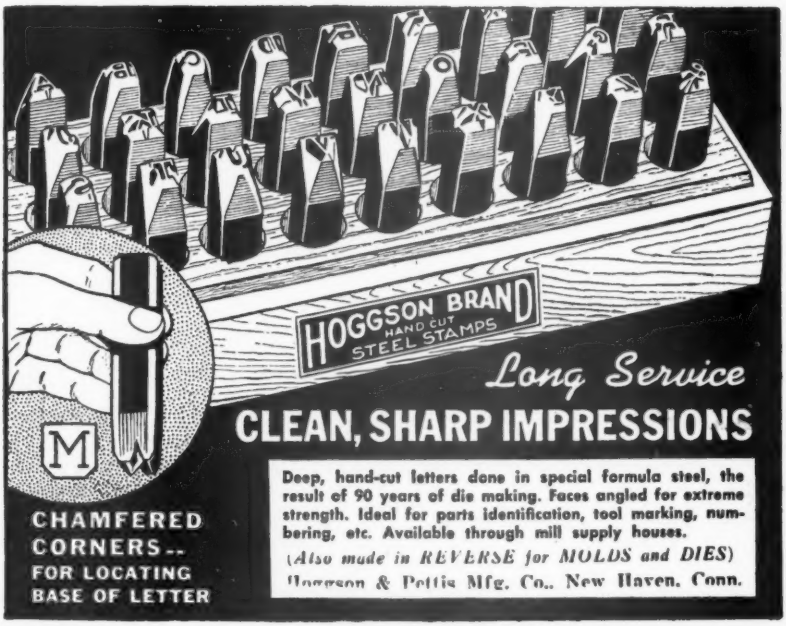
Standard sizes and styles in stock for prompt delivery.
Write for catalog showing table of standard sizes of bushings with price list and other valuable information for the tool designer.

REPRESENTATIVES

BUFFALO, N. Y. — Kelly Tool Co. CLeveland 8196
NEW YORK, N. Y. — Carlton Eberhard Wisconsin 7-9193
HOUSTON, TEXAS — Chickering Tool & Equipment Co. W-6-8384
DAVENPORT, IOWA — Davenport Engineering Co. Dial 2-2279
SEATTLE, WASH. — H. F. Soderling Co. MAin 8836
*DETROIT, MICH — Booth & Shaw TEmple 1-4040
CHICAGO, ILL. — Prescott Production Tool Co. ARmitage 3364
*STRATFORD, CONN. — Ellsworth Steel & Supply Co BRidgeport 7-3317
PHILADELPHIA, PA. — Albert R. Dorn DElaware 3333
LOS ANGELES, CALIF. — Walter W. Miller PRospect 2687

*Stock carried at these locations

ACCURATE BUSHING COMPANY, 440 North Ave., GARWOOD, N. J. WEstfield 2-2415



Long Service

CLEAN, SHARP IMPRESSIONS

Deep, hand-cut letters done in special formula steel, the result of 90 years of die making. Faces angled for extreme strength. Ideal for parts identification, tool marking, numbering, etc. Available through mill supply houses.

(Also made in REVERSE for MOLDS and DIES)

Hoggson & Pettis Mfg. Co., New Haven, Conn.

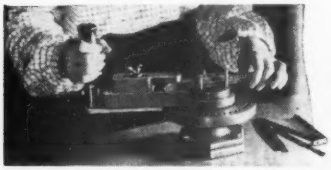
CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

Talk About PRODUCTION Without DIES!

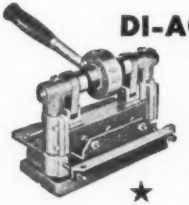
4,000 PARTS per DAY with DI-ACRO Bender

"Enclosed pictures in our plant prove the DI-ACRO Bender will do a real production job. We are making 4,000 completed parts per day which is competitive to most Power Presses." (Name on Request.)

Here is an example of "DIE-LESS DUPLICATING" typical of a great variety of formed parts readily made with DI-ACRO Precision Machines, — Benders, Brakes, Shears. Picture below shows the DI-ACRO Bender making an acute right angle bend and photograph above shows the finished part formed to die precision. Women operating DI-ACRO units maintain a high out-put on production work.



Pronounced "DIE-ACK-RO" ⟹



DI-ACRO Shear

Squares and sizes material, cuts strips, makes slits or notches, trims duplicated stampings. 3 sizes. Shearing widths, 6", 9", 12".

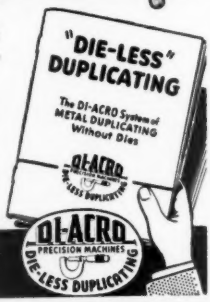
★

DI-ACRO Brake

Forms non-stock angles, channels or "Vees". Right or left hand operation. 3 sizes. Folding widths, 6", 12", 18".

Send for Catalog

showing DI-ACRO Precision Machines and many examples of parts made with "DIE-LESS DUPLICATING".


"DIE-LESS" DUPLICATING
The DI-ACRO System of METAL DUPLICATING Without Dies
DI-ACRO
DI-ACRO PRECISION MACHINES "DIE-LESS" DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 EIGHTH AVE. SOUTH • MINNEAPOLIS 15, MINNESOTA

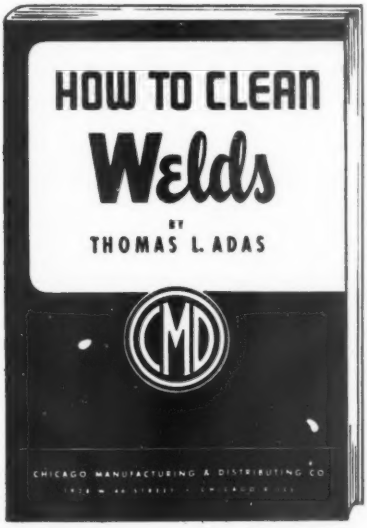
SHOP AIDS

For You And Your Job

Use our postage-free Inform-a-Gram for your requests.

GRINDING, SANDING, BUFFING, WIRE BRUSHING, drilling, reaming, screw driving, and nut setting are operations performed by the new Rotor Air Tools. Discussing nine case histories of cutting costs in nine fields along with actual amounts saved by using the right tool for each job, Booklet No. 30 contains 44 pages of valuable information. Write The Rotor Tool Company, Dept. 4-49, 17325 Euclid Ave., Cleveland Ohio, or use INFORM-A-GRAM Key No. 449-Q.

"HOW TO CLEAN WELDS" covers all phases of weld cleaning and provides complete instructions on the subject for experienced welders as well as beginners. Plant managers will find valuable data and suggestions on improving workmanship, increasing production, and reducing costs. Subjects include: importance and methods of weld cleaning; how to clean arc and gas welds,



tests of a clean weld, cleaning before, during and after welding; effect of rust, oil and dirt on welds; and cleaning subsequent beads, fillets, and grooves. The booklet is offered by Chicago Manufacturing & Distributing Co., Dept. 5-90, 1928 W. 26 St., Chicago, Ill., or use INFORM-A-GRAM Key No. 590-Q.

"PRODUCTION ILLUSTRATION", by John Treacy, is a completely thorough exposition of production illustration from all pertinent aspects. The widespread adoption of perspective illustration as a medium of engineering presentation created a demand for an exposition of the principles and techniques which has been confirmed by actual industrial usage. Though the material in this book has been drawn mainly from the aircraft industry, the methods are applicable to almost any product or type of manufacture. None of the text and only a few of the illustrations have appeared in any other publication. The illustrations selected for examples are actual production drawings, and will incorporate the most practical and widely accepted standards.

This subject falls into two main parts which may overlap. First is the actual preparation of production illustrations—the drafting and shading techniques, short cuts, perspective methods, reproduction aids, and other "tricks of the trade". Second is the introduction and practical application to the problems of industrial production—the why, what, when, and where.

Copies of this 202-page book are available from John Wiley & Sons, Inc., Dept. DJ, 440 Fourth Ave., New York, N. Y. Price $4.00.

DO YOU KNOW that grinding is the cutting action of thousands of abrasive grains on the face of the grinding wheel and that the grains actually cut chips out of the work? "A Handbook on Abrasives and Grinding Wheels" presents, clearly and concisely, a liberal amount of information on the subject. Discussion on grinding wheel structure and marking is easily understood; proper selection is advised; tables and data on wheel speeds and spindle diameters are easily absorbed. Operating rules and hints offer safe use, care

and protection of abrasive wheels. Grinding wheel recommendation and selection tables, definitions and available printed matter complete information herein contained. Norton Company, Dept. 5-45, Worcester 6, Mass., will honor your request for a copy, or use INFORM-A-GRAM Key No. 545-Q.

"EVERYDAY MIRACLES", a 25-minute sound motion picture, dramatizing recent contributions to industrial progress by Carboloy cemented carbide, is released by Carboloy Company, Inc., Detroit, Mich. The picture was produced "on location" at Carboloy's main plant in Detroit. It is designed to familiarize users of hard metal carbides with recent accomplishments resulting from the use of these metals, and also to stimulate thinking as to possible new applications. The picturization of how carbides are made should prove interesting and valuable to industrial groups in view of the relation of this subject to utilization of hard metals. For further information, write or wire: Denham, Dept. 82, 812 Book Bldg., Detroit 26, Mich., or use INFORM-A-GRAM Key No. 82-Q.

SOLVING FORMING AND PUNCHING PROBLEMS occurring in the sheet metal industry is facilitated by the Verson Bending and Punching Calculator, now available to shop supervisors, engineers, and executives in metal-working plants. This handy device gives die opening and press capacity required for making 90° bends in mild and stainless steel of all commonly used gauges. It indicates tons per hole required to punch holes of 8 different sizes in mild steel plate of a wide variety of gauges. It may be obtained free of charge by writing Verson Allsteel Press Company, Dept. 68, 1355 E. 93rd St., Chicago 19, Ill., or use INFORM-A-GRAM Key No. J68-Q.

CENTERLESS GRINDER OPERATORS will be interested in "Waltham Centerless", a bulletin containing suggestions for centerless grinding operators. The material describes and illustrates machine adjustments which will aid the operator secure proper results from thru-feed and in-feed centerless grinding. The useful illustrations and text make easy reference for the operator. Waltham wheel markings are described for proper selection of wheels. Direct inquiries for Bulletin No. 16 to Waltham Grinding Wheel Company, Dept. 66, Waltham, Mass., or use INFORM-A-GRAM Key No. J66-Q.

COVERING VIRTUALLY EVERY PHASE OF BROACHING METHODS, broaches, and broaching equipment, a Combined Broaching Manual and Catalog has been published by the Colonial Broach Co. for use of shop and manufacturing executives, master mechanics, chief tool engineers, and purchasing agents. Complete and up-to-date, it is divided into six sections, and has an extensive cross-referencing system, supplemented by an index. The section relating to involute splines is particularly complete, covering 34 pages. Address requests for No. CB-46 to The Colonial Broach Co., Dept 26, P. O. Box 37, Harper Station, Detroit, Mich., or use INFORM-A-GRAM Key No. 26-Q.

"THE DEVELOPMENT OF MATHEMATICS," by E. T. Bell, Professor of Mathematics, California Institute of Technology. The author's presentation of this subject was motivated by two factors. The first was the request from numerous sources, principally students and instructors, for a broad account of the general development of mathematics, with particular reference to the main concepts and methods that have, in some measure, survived. The second was his personal association for several years with creative mathematicians in both the pure and the applied divisions. The text is not a history of the traditional kind, but is a narrative of the decisive epochs in the development of mathematics. This new, second edition contains about fifty pages of new material. The additions include numerous short amplifications of miscellaneous topics from Greek mathematics to mathematical logic, with longer notes on symbolism, algebraic and differential geometry, lattices, and other subjects in which there have been striking recent advances.

"The Development of Mathematics," second edition, is published by McGraw-Hill Book Co., 330 West 42nd Street, New York 18, N. Y., and is priced at $5.00.

INVESTIGATION OF THE STRENGTH OF RIVETED JOINTS IN COPPER SHEETS is discussed in Bulletin No. 360, recently issued by the University of Illinois. Various ways, in which a riveted joint connecting copper sheets might fail, are pointed out; tests, planned to determine strength of riveted joints against failure by these methods, are described. Detailed results of tests made to determine effect of rivet pattern upon strength of sheets, to determine relation between load and slip of the rivets and between load and separation of sheets at edge of joint, and to determine shearing strength of undriven rivets of all diameters, are presented. The bulletin will be mailed free on request from Engineering Experimental Station of the University, Dept. 39, at Urbana, Ill.

GIVING COMPREHENSIVE EXPLANATIONS of grain sizes, types and fundamentals of grinding wheel operation, the 94-page booklet, "Grinding Wheel Information", is easy to read and also well illustrated with photographs and cross-section line drawings. Write Mid-West Abrasives Co., Dept. 3-94, Owosso, Mich., or use INFORM-A-GRAM Key No. 3J4-Q.

WHEREVER HOLES ARE BORED

You need low-cost
OPTI-LOCATOR!

OPTI-LOCATOR—
Visually aligns reference marks to axis of spindle rotation.

- Corrects for spindle runout.
- Makes all locating problems simple, accurate, positive.
- Can be used on any machine tool for greater precision in boring, measuring or locating.

Write for Free Folder illustrating simple operation and many uses!

THE BENTON CO.
DEPT. T, 351 S. LA BREA AVE.,
LOS ANGELES 36, CALIF.

MANUFACTURERS OF OPTI-TOOLS

TU-MY-CO

TRADE TUMICO MARK

VERNIER CALIPERS

Made for LASTING DEPENDABILITY

Graduations and numerals applied by a new scientific acid etching process to a depth of .002, assuring a degree of accuracy and permanency heretofore unknown in tools of this type. See illustration below.

Graduated on both sides in English—one side for outside measurements, the other for inside measurements.

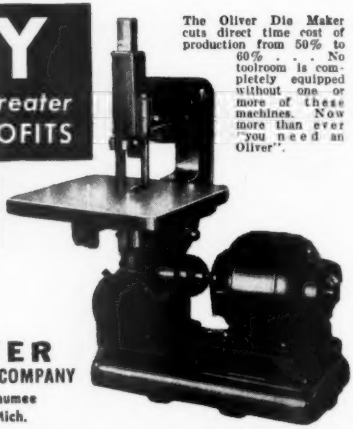
No. 75 SERIES—4 sizes—6, 12, 24 and 36-inch—length of jaws $1\frac{1}{4}$", $2\frac{3}{8}$" and 3" on the two larger sizes. Sold with or without case. ASK YOUR JOBBER.

Precision is a TU-MI-CO Tradition

WRITE FOR BULLETIN TD-V

TUBULAR MICROMETER CO.
ST. JAMES, MINNESOTA, U. S. A.
Milwaukee Branch • Plankinton Bldg.

The Oliver Die Maker cuts direct time cost of production from 50% to 60% . . . No toolroom is completely equipped without one or more of these machines. Now more than ever "you need an Oliver".



Savings in your toolroom time will soon pay the low initial cost.

IMPROVE YOUR TOOLROOM
IT'S THE BACKBONE
OF PRODUCTION

OLIVER
INSTRUMENT COMPANY
1436 E. Maumee
Adrian, Mich.

OLIVER OF ADRIAN

AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS—DRILL
POINT THINNERS—TEMPLATE
TOOL GRINDERS—FACE MILL
GRINDERS—DIEMAKING MACHINES

IF YOU DESIGN, MAKE OR HEAT TREAT TOOLS OR DIES

This 315-page shop handbook can be a real help to your tool makers and heat treaters. It can help them select and heat treat the right tool steel for the job. Today, "Tool Steel Simplified" is being used in many plants to improve tool performance and cut costs, to save time and money all along the line.

Send today for your copy of this authoritative, inexpensive handbook for all men who are responsible for designing, making or heat treating tools and dies.

MAIL TODAY

THE CARPENTER STEEL COMPANY
Reading, Pa. Dept. 9-U

Please send me postpaid a copy of TOOL STEEL SIMPLIFIED. I enclose $1.00 ($3.50 outside the U. S. A.) in full payment for the book.

*Name*_____ *Title*_____

*Firm Name*_____

*Mailing Address*_____

*City*_____ *Zone*____ *State*_____

PLEASE PRINT

TOOL STEEL SIMPLIFIED

By FRANK R. PALMER
Vice-President of
The Carpenter Steel Company

★

315 *Pages* 205 *Illustrations*
$1.00 *Postpaid in U.S.A.*
Elsewhere $3.50

CUT COSTS 3 WAYS! WITH CARBOLOY

DIAMOND IMPREGNATED WHEEL DRESSERS

and GET MORE UNIFORM DRESSING, TOO!

CLUSTERS OF DIAMONDS!

Special Carboloy Cemented Carbide matrix diamond-loaded from base to peak, holds particles securely. With many diamonds you get more uniform dressing. 3 Standard D.I.C. Dressers for fast dressing of a wide range of rough, semi-finish and finish grinding wheels.

1. LOWER INITIAL COST

Carboloy D.I.C. Dressers cut your initial costs, because they are priced about 50% below single-point dressers. *And,* they give you *diamond-dressing at its best!*

2. LOWER MAINTENANCE COST

Single-point diamond dressers require frequent re-setting—expensive, and time consuming. D.I.C. Dressers can be reconditioned in a few minutes *in your own shop.*

3. REDUCED INVENTORY

No need to carry a stock of replacement dressers to "fill in" while others are out being re-set. D.I.C. Dressers require no re-setting.

FOR BEST RESULTS WITH YOUR CARBOLOY CEMENTED CARBIDE WHEEL DRESSERS—

- **Be sure to use correct traverse feed, to get maximum number of pieces, and to avoid wheel-glazing. (For Table of Correct Traverse Feeds, send for free Booklet DR-101).**
- **Avoid making too many passes without infeed.**
- **To avoid dressing taper, turn dresser one-quarter turn in holder.**
- **Reconditioning takes only a few minutes, and can be held to a minimum by making sure tool is mounted correctly and turned often.**

Also Sold By
Leading Mill Supply Distributors

CARBOLOY COMPANY, INC.
11109 E. 8 MILE BLVD. • DETROIT 32, MICH.

CARBOLOY

WHEEL DRESSERS

"RAWHIDE PROTECTS" CHICAGO RAWHIDE PROTECTS MOST

Chicago Rawhide hammer faces of coiled rawhide may be quickly replaced in the permanent malleable iron heads.

For "soft" mallets and hammers, no other material has the *natural* protective qualities of tough, coiled rawhide. It protects finished surfaces, valuable machines and expensive dies... delivers maximum striking power and durability at the same time.

Fifty-eight years of experience in selecting, processing and seasoning mechanical rawhide is behind every Chicago Rawhide mallet and hammer. This is your assurance of a *rawhide* hammer or mallet that will stand up under severe, continuous blows—and still furnish maximum protection. Always specify *Chicago* Rawhide.

CHICAGO Rawhide MFG. CO.

1209 ELSTON AVE. · CHICAGO 22, ILLINOIS

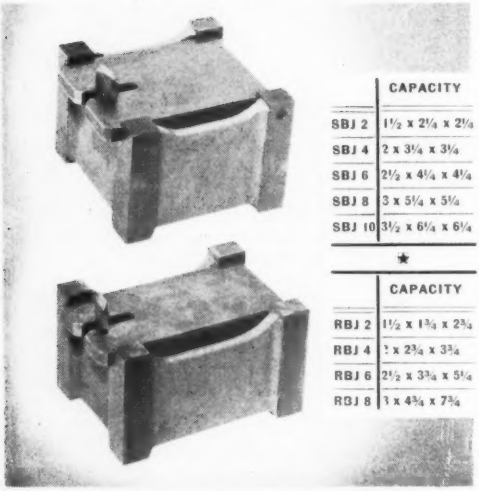
Standardize with these *TIME SAVERS* . . . Order Today

IMMEDIATE DELIVERY

At one-half your cost to build, you can stock in your own tool crib any or all "27 Varieties" of Noble & Stanton's *standardized* Jig and Fixture Components in a full range of sizes to meet your every need—just as you stock drill jig bushings and cutting tools. These *standard* parts, "*The Chrome Plated Line*", supplied with full size templates for tracing, can save their cost in your designers' time alone.

Noble & Stanton's large production runs and careful quality control assure strength and durability at costs far below custom building. Furthermore, Noble & Stanton's "27 Varieties" of Jig and Fixture Components are made of steels best suited to each application. Also, they are processed to precision standards and, for your protection, they are heat treated and chrome plated wherever practical.

A price list and portfolio containing actual size drawings and specifications are available upon request.



	CAPACITY
SBJ 2	1½ x 2¼ x 2¼
SBJ 4	2 x 3¼ x 3¼
SBJ 6	2½ x 4¼ x 4¼
SBJ 8	3 x 5¼ x 5¼
SBJ 10	3½ x 6¼ x 6¼

★

	CAPACITY
RBJ 2	1½ x 1¾ x 2¾
RBJ 4	2 x 2¾ x 3¾
RBJ 6	2½ x 3¾ x 5¼
RBJ 8	3 x 4¾ x 7¾

ONE OF THE "27 VARIETIES" STANDARDIZED BOX JIGS

Normalized cast iron body squared to + .001 tolerance
Precision fitted finished machine steel gate
Hinge pin hole line drilled and reamed at precisely 90°
Precision fitted pin easily removed
Gate will not bind or shake
Noble & Stanton quarter-turn screw included
Hardened jig feet, if desired

Representatives in Principal Cities

NOBLE & STANTON, INC.
Manufacturers of Tools, Gages and Their Accessories
BEDFORD, OHIO

"27 VARIETIES"

The Chrome Plated Line

- **Adjusting Head Screws**
- **Adjusting Half Nuts**
- **C-Washers**
- **Cam Action Clamps**
- **Clamp Rests**
- **Flange Nuts**
- **Gang Mill Fixture Bases**
- **Ground Thread Studs**
- **Heel Clamps**
- **Heel Clamp Assemblies**
- **Hand Knob Clamp Assemblies**
- **Hand Knob Clamps**
- **Hex Jig Feet**
- **Jig Feet**
- **Knob Shoe Assemblies**
- **Mill Fixture Bases**
- **Quarter Turn "Lightning" Clamps**
- **Quarter Turn Screws**
- **Rectangular Box Jigs**
- **Square Box Jigs**
- **Stud Drivers**
- **Swing Bolts**
- **Swing Clamps**
- **Spherical Washers**
- **Socket Head Shoulder Screws**
- **T-Angle Plate Fixtures**
- **Precision V Blocks**

Substitute TIMESAVER LAPPING COMPOUND

For Expensive Hand Scraping and Running - In Operations

A gear lapped to precision, in assembly, with Timesaver Compound

PRODUCE PERFECT FITS
ASSURE QUIET OPERATIONS

You can produce perfect fits, assure quiet operation and save time and money by substituting Timesaver Lapping Compound for expensive hand scraping and running — in operations.

Timesaver is easy to use and rapidly produces perfect fitting bearing surfaces.

Timesaver Compound will not imbed into any metal nor will it continue to cut.

Used by leading manufacturers for the past twenty years for the fitting of all types of gears, bearings, valves, pistons, slides, etc.

Grades for lapping hard and soft metals.

A request on your letterhead will bring FREE SAMPLES and complete data.

TIMESAVER PRODUCTS COMPANY
31 S. Desplaines St. ◆ Chicago 6, Illinois

SENSATIONAL, NEW, EXPANDING MANDREL DESIGN . . . . OPERATION CYCLE SPEEDED — EXTRAORDINARY PRECISION

CURTISS-WRIGHT CORPORATION RANKS OUR PRODUCT WITH *THEIR* BEST TOOLS. CLEVELAND GRAPHITE BRONZE COMPANY, LEADING BEARING MANUFACTURER, STATES NEW HIGH ACCURACY REACHED, PLUS SUBSTANTIAL PRODUCTION BOOSTS.

WITH

YOUNG ROLLER CLUTCH PRECISION MANDRELS

Time-tested Overrunning Clutch —Patent Pending

Quotations Definitely Moderate

Good delivery Schedules

NO MORE "C" WASHERS, WRENCHES, DRAWBARS, NO MORE ARCS OR TAPERS BEFORE OR AFTER EXPANSION GRIP — CONCENTRICITY IN LOW 10,000ths — PRODUCTION OR INSPECTION.

Assured parallelism of sleeve surface to center line —absolutely no variation in repeated mounting of parts — no tapers. Uniform full-work-length friction-locking gives complete control and contact of entire bore area. Slip part on mandrel with slight counter-clockwise motion, that's all — it's ready — Self-contained, self-expansion, self-locking, self-contraction. Instant unloading, no jamming, no adjusting — Interchangeable sleeves — Built to your bore tolerance high limit, with automatic contraction to low limit — Any mounting — Any machine operation — For bore diameters .500 and up — Reduces tool costs, extra equipment investment, operating costs, maintenance, down time, scrap, salvage.

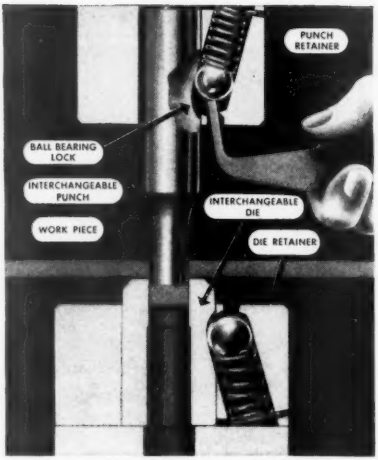
ROUGHLY SKETCH DESIRED MANDREL INTO YOUR PART PRINT AND FORWARD FOR QUOTES.

YOUNG ARBOR CO., 3257 Bradford Road, Cleveland Heights 18, Ohio

PUNCHES and DIES are *Quickly* INTERCHANGEABLE

Allied's R-B Interchangeable Punches and Dies are quickly installed for trouble-free production in the metal-working and plastics industries. They are available from stock in *standard* round, oblong and square shapes of almost any required size. Specials of any size, shape or material are promptly furnished to your specifications—and delivery dates are *dependable.*

Write today for large illustrated R-B Catalog



ALLIED PRODUCTS CORPORATION

Department 20 ● 4634 Lawton Ave. ● Detroit 8, Michigan

This Evans adjustable **CHUCKING REAMER**

ASKS NO FAVORS

The new Evans Adjustable Chucking Reamer is made in three models. CR has a straight shank ...CT has a tapered shank. SR is a stub reamer. All have left hand spiral flutes with an 18° helix angle. That's why these reamers can finish holes with keyways, slots, oil grooves and other interruptions.

All of these reamers are available for immediate shipment. Sizes range from ¾″ to 1½″. They have an expansion range of .025″ to .031″, depending on diameter.

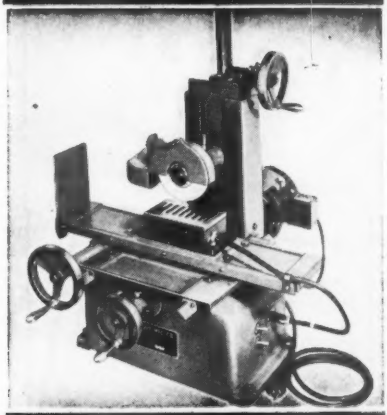
Decide right now to put these reamers to work for you . . . and cash in on all the money-saving advantages they have to offer.

We will be glad to send prices and sizes. Just drop us a line.

EVANS

REAMER AND MACHINE COMPANY • 512 South Main St., New Lexington, Ohio

SANFORD



High-Speed BENCH SURFACE GRINDER

ACCURATE WITHIN .0001

A sensitive machine built to rigid standards of accuracy and workmanship specially designed *"For the job that fits in your palm."*

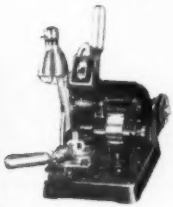
WRITE FOR BULLETIN

SANFORD MFG. CO.
1020-28 Commerce St.
Union, N. J.

Mill SMALL PARTS *Fast • Accurately*

with this

NEW *Rouse* HAND MILLER



$98 (Without Fixtures)
F.O.B. Chicago, Motor Extra

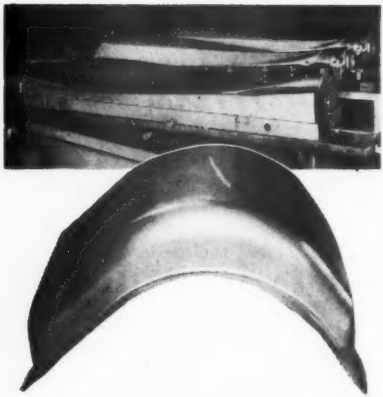
Rouse
Fixture Set-Ups that Speed Production.

It's a high-speed, motor-driven unit that has many uses in finishing operations for light cuts on aluminum, brass, steel and other metals . . . also, rounding and burring steel and cast iron. Inexperienced operators quickly learn to use it with speed and precision.

The Rouse Hand Miller, with Rouse Fixture Set-Ups, provides fast, accurate, low-cost milling for a big variety of small parts used in electrical work, instruments, aviation, communications and similar work.

Available for immediate shipment. Write for illustrated circular and full details.

H. B. ROUSE AND COMPANY
2216 North Wayne Avenue — Chicago 14, Illinois



FORWARD DRAWINGS FOR ESTIMATE!

Dies built of ***Strenes Metal*** are usually available for use quicker because there is far less machining time involved—a real cost economy.

Strenes Metal dies invariably deliver several times the usual number of stampings between redressings, regardless of the depth of the draw—a tremendous production advantage.

Heaviest users of ***Strenes Metal*** dies include car, truck, tractor, farm implement manufacturers; also stove, refrigerator, casket and vault builders.

Perhaps you should be using ***Strenes Metal*** dies. Send in your drawings for study and estimates.

The Advance Foundry Company
DAYTON 3, OHIO

Strenes METAL
FOR DRAWING AND FORMING DIES

the new.....
CARDINAL NO. 18 SLO-DRIVE

- DOUBLES
- DRILL PRESS
- CAPACITY

•$250.00 NET

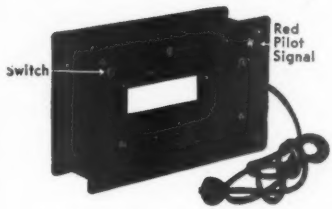
THE NEW CARDINAL NO. 18 "SLO-DRIVE" REDUCES SPINDLE SPEEDS OF POPULAR 18" TO 20" DRILL PRESSES TO A RANGE ACCOMMODATING DRILLS AND OTHER TOOLS UP TO 1" DIAMETER OR LARGER. UNIT RUGGEDLY CONSTRUCTED, INTERCHANGEABLE, EASILY INSTALLED. COMPLETE SPECIFICATIONS UPON REQUEST.

CARDINAL MACHINE COMPANY
GLENDALE, CALIFORNIA
"THE ~~SPEED VISE~~ MANUFACTURER"

WITH high speed automatic equipment for volume — with separate department for prompt handling of small orders and experimental work — with 75 years successful experience guiding each step from design to delivery—this is the source for quality springs. Your inquiries invited.

THE WILLIAM D. GIBSON CO. DIVISION 1800 CLYBOURN AVENUE OF ASSOCIATED SPRING CORPORATION **CHICAGO 14, ILLINOIS**

Save TOOLS · TIME · LABOR *with the Improved* · AMC · DEMAGNETIZER



No shop or toolroom can afford to be without one. Thoroughness of the AMC Demagnetizer will give greater precision to finished parts.

One pass through AMC Demagnetizer removes all magnetism from processed parts. Large flat surfaces are demagnetized by sliding unit over surface.

● **Our AMC Demagnetizer will pay for itself in a few weeks. Standard units available, and special sizes to order.**

▶ *Write today for illustrated circular.* ◀

ALOFS MFG. CO.

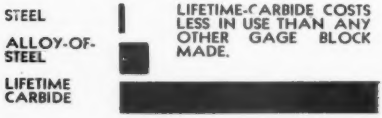
1619 Madison **Grand Rapids, Mich.**

You're Buying

LIFETIME ACCURACY

...WHEN YOU PURCHASE FONDA LIFETIME-CARBIDE GAGE BLOCKS

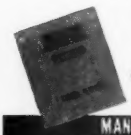
BY TEST: Accelerated wear-resistance tests show the average wear of gage blocks of three types to be: Lifetime-Carbide, —11 Millionths; Alloy-of-Steel, —133 Millionths; Steel, —1530 Millionths. These recent tests, using a common shop abrasive, show conclusively that Lifetime-Carbide has a life as much as 139 to 1 over other types of gage blocks.



NOTE: Further proof of the universal acceptance of carbide as the most wear-resistant gage-block material is the recommendation, by other gage block manufacturers, *of the use of carbide wear-blocks to prolong the life of their steel and alloy-of-steel gage blocks.*

BY SHOP EXPERIENCE: A Fonda customer used a 35-C set of Lifetime-Carbide blocks in the grinding room of their plant, subjecting them to extreme punishment on two shifts daily. In six months the set had received a normal 10 to 15 years' usage. Inspected at the end of this time, the calibration certificate attested that not one worn gage block could be found. No wear observed—not one millionth! Heretofore, they had found their inspection sets to wear from 10 to 25 millionths in three month's time, though handled with meticulous care in a temperature-controlled laboratory.

Write for complete details



FONDA
GAGE COMPANY
Stamford, Connecticut
MANUFACTURERS OF LIFETIME-CARBIDE AND STEEL GAGE BLOCKS

MIRROR FINISHES
in Minutes instead of Hours

On Tungsten Carbide, Tool Steels, Special Steels, Chrome, etc.

WITH STAR DUST

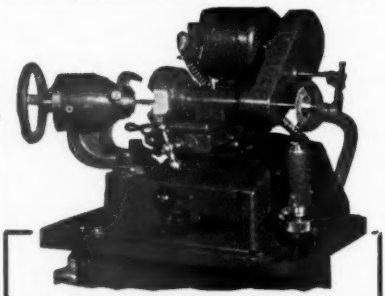
Laboratory Graded

Pure Diamond Powders and Diamond LAPPING COMPOUND

Produces super-finishes and polishes down to less than a MICRO-INCH with INCREDIBLE SPEED.

Write us your lapping problems. No obligation.

ACE ABRASIVE LABORATORIES
1 SPRUCE STREET • NEW YORK 7, N. Y.



HYBCO TAP GRINDERS
Sharpen ALL The Vital Points
CHAMFER • FLUTES • SPIRAL POINT
- *Fast—easy to operate.*
- *Complete—no parts to change.*
- *Capacities—#2 to 1½" hand taps—with interchangeable heads.*

HEADS ONLY AVAILABLE FOR USE ON UNIVERSAL TOOL & CUTTER GRINDERS
Write for Circular TGH

HENRY P. BOGGIS & CO.
1277 W. Third St., Cleveland, O.

DRIVE ALL
TRADE MARK REG. U.S. PAT. OFFICE

System Of Individual Motor Drives

for all kinds of machines and equipment requiring one or many speeds.

1 Speed
3 Speed
4 Speed
} Models

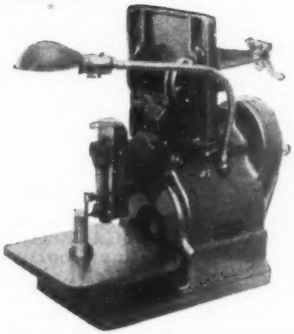
- Complete units for Brown & Sharpe, Cleveland and other automatics.
- 3- and 4-speed DRIVE-ALL Gear Transmissions provide a selective change of speeds through finger-tip control.

- Single speed transmissions, for machines running at a constant speed, provide better use of higher speed motors through larger driving pulleys, such as are required for efficient punch press operations.

COMPLETE INFORMATION FURNISHED UPON REQUEST

DRIVE-ALL MANUFACTURING CO. 3400 CONNER AVE. DETROIT 14, MICH.

RETRACTABLE FILE—feature of NEW (D-5) DUPLEX FILING MACHINES for rapid filing or sawing of DIES, CAMS, KEYWAYS, FORM CUTTERS, TEMPLATES, BLIND HOLES, MOLDS, FLANGED PUNCHES.



DIE TABLE swings up vertically.

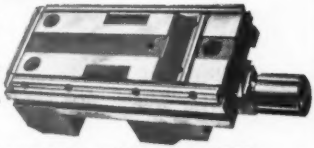
ULTRA PRECISION

SINE VISES *Master Gage Builders!*

For SURFACE GRINDING, LAYOUT, INSPECTION OF GAGES, TOOLS, AND FINE INSTRUMENTS

No. 2 (Sine of 5') TILTS ONE WAY as Sine Bar. Opens Three Inches Size, 6"x2½"x2¼"

No. 3 TILTS THREE WAYS Sine of 6" & 3" Size 7½"x3½"x2¼" Opens 3½"



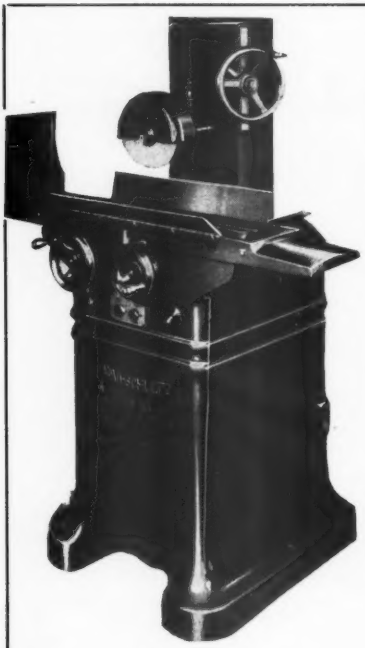
HARDENED, GROUND, LAPPED

Features Include:

1. Precision Sine Rolls
2. Non-Projecting, fully covered, Telescoping Screw
3. Removable Grip Screw Knob
4. Prismatic Slide Jaw
5. Accurate Integral V-Block
6. Tolerance .0002"

WRITE FOR CIRCULARS

IDEAL TOOL and DIE CO., INC. - 735 CONGRESS STREET SCHENECTADY, N. Y.



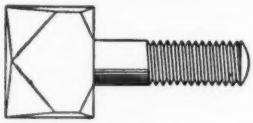
BOYAR-SCHULTZ NO. 618
PRECISION SURFACE GRINDER

A MACHINE TOOL designed to give the fine finish and high degree of accuracy necessary in the finest gage grinding and tool and die making.

It is built with a sturdy ruggedness that maintains that fine accuracy for a long period of time . . . much longer than most similar tools are expected to last.

Such long lasting precision performance gives the inevitable result of greater economy.

BOYAR-SCHULTZ CORPORATION
2112 WALNUT STREET • CHICAGO 12, ILL.



STEEL FORGED QUARTER TURN SCREWS
FOR JIGS AND FIXTURES
Send for Catalogue "A"
INTER-STATE DESIGNING & TOOL CO.
3515 N. 10th St. Philadelphia 40, Penna.

SEND US YOUR PRINTS FOR *Quotations*

THREAD GRINDING
BROACHING
MAGNETIC INSPECTION

TAYLOR
MACHINE COMPANY
MANUFACTURERS OF
AVIATION & AUTOMOTIVE PARTS
Gear Specialists
1917 EAST 61ST ST • CLEVELAND 3, OHIO

MACHINE SHOP TOOLS
DRILLS - REAMERS - MILLING CUTTERS
- TAPS - DIES - ROTARY TABLES
AND PRODUCTION TOOLS
SEND FOR OUR 220 PAGE CATALOG
Lafayette Tool & Supply Co.
128 Lafayette St., New York 13, N. Y.

Variable
Center Scope
The world's standard of accuracy in locating layout lines, centers, holes or edges. Fast, foolproof.
Write for Catalog No. 10
Center Scope Products
3829 San Fernando Road
Glendale 4, Calif.
Dealers in Principal Cities.

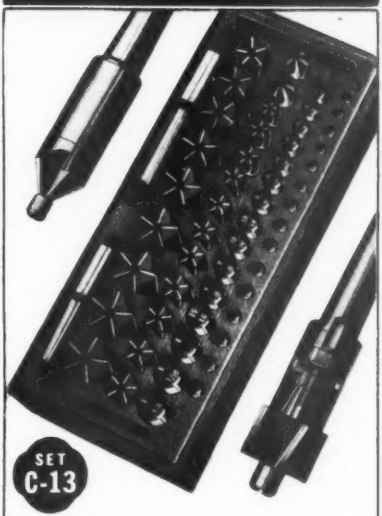
For heavy duty counterboring requiring rigidity, strength and perfect alignment, choose Gairing's type C. The handy kit shown below, gives you a wide range of cutter and pilot combinations.

COUNTERBORE SETS

Write for Folder and Prices

THE GAIRING TOOL CO.

Roosevelt Park Box 478 Detroit 32 Mich



Sturdy box with hinged cover contains: holders C-12 and C-13; 20 cutters from 9/16" to 1 3/4"; 28 pilots from 9/32" to 1 1/8" and two 7/8" countersinks, one 70° and one 82°.

GAIRING TOOLS

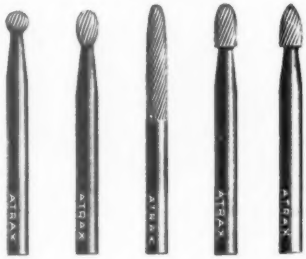
Set of 12 1/8" Carbide Burs

ATRAX

Precision Machine Ground

1/8" CARBIDE BURS

1 1/2" long



Cut filing and finishing costs 5 to 10 times.

ASK FOR BULLETIN A-51

ATRAX

The ATRAX Co.

240 Day Street

NEWINGTON 11, CONNECTICUT

BURKE

MILLING MACHINES

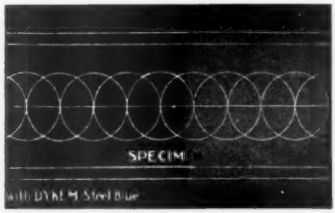
No. 4 Motor Driven MILLING MACHINE Mounted on Cabinet Column

Burke motor driven milling machines Nos. 1, 2, 3, and 4 are specially suited for handling small, difficult work on a production basis.

Write for complete information.

Burke Machine Tool Co.

301 E. 16th St. -:- Conneaut, Ohio



DYKEM STEEL BLUE *STOPS LOSSES* making dies and templates

Simply brush on, ready for the layout in a few minutes. The dark blue background makes the layout lines show up in a sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information.

THE DYKEM COMPANY

2201 N. 11th Street St. Louis, Mo.

when you want Speed-
when you want power-

. . . in your job of sanding, filling and rubbing, drilling or screw-driving, you want a Strand Flexible Shaft machine, because a Strand will do it faster, better, and stand up to it longer.

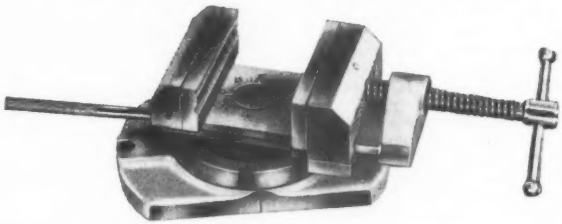
Strand Flexible Shaft machines provide constant speeds with greater operator convenience. Hundreds of attachments easily interchanged—125 types and sizes—models include vertical and horizontal type machines from ⅛ to 3 h.p. Distributors in all principal cities.

Send today for catalog showing complete line

Strand FLEXIBLE SHAFTS

N. A. STRAND & CO.
5003 NO. WOLCOTT AVE. CHICAGO 40, ILL.

PRECISION *Swivel* VISE



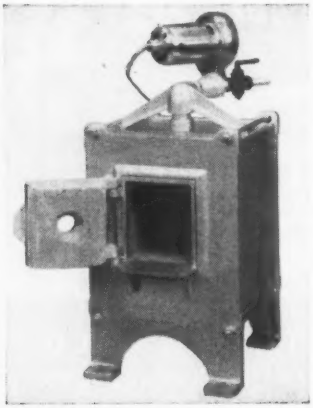
Equipped with Gardner Floating Jaw for Instant Gripping • Single Movement Adjusts and Secures • Clear Vision Setting

No.	Width of Jaw	Depth of Jaw	Jaws Open	Height With Vise Horizontal	Net Weight Lbs.	Price F.O.B. Chicago
V935	3½"	1¼"	2½"	3⅛"	10	$28.00
V945	4½"	1⅝"	3¼"	3⅛"	11½	36.00

MACHINISTS TOOL COMPANY
2830-36 West Lake Street
Chicago 12, Illinois

NEW

High Temperature Burner Furnace Heats Faster . . . . Saves Money



THE MIDGET UTILITY FURNACE

Heating chamber 4½" wide, 5¼" high, 9" deep; extra depth easily obtainable by change of plates; entire lining of standard insulating fire brick.

Here's a small, rugged bench furnace that's ideal for hardening small parts and tools, forging soldering coppers, general forging, brazing and a wide variety of other jobs. Because of its new type, high temperature burner it heats very quickly, saves real money. Complete rapid combustion; wide temperature range; maximum turn-down; burns any fuel gas; *2400° F in 12 minutes.* Equipped with blower (110v. AC-DC motor). Also available with mixing tee for compressed air (2 lbs. or more) or inspirator for high pressure gas.

Only $79.00 Complete

Prompt Delivery

GAS APPLIANCE SERVICE, INC.

Flame Hardening with City Gas and Air
Industrial Gas Engineers

1205 Webster Ave. Chicago 14, Ill.

Square, Straight Tapping in HALF THE TIME

The Dahlstrom Tap Guide practically eliminates tap breakage, and turns out uniform work. Just fasten it to a post or bench, slip a Tap Adaptor into the spindle, and turn the handle. Equipped with 7 Adaptors from 8/32 to ½" (taps not furnished). Ask your mill supply house, or order direct. Literature on request. Dahlstrom Mfg. Co., 422 South Sixth St., Minneapolis 15, Minn.

Dahlstrom TAP GUIDE

MODEL C ANGLE COMPUTER

Specially designed for general shop use, this moderately priced instrument insures quick, accurate survey of precision measurements involving vertical and horizontal angles. From either of these two working positions, both available at all times, the work can be rotated 360 degrees. Protractor and vernier are calibrated in one minute, or 21,600 precise divisions. These give the Model C Studler Angle Computer extreme capacity in layout and inspection.

Face Plate 10" dia. 1" thick, #4 Morse Taper Spindle Attachment

Surface Plate (interchangeable) 5"x10" x⅝" Rib-reinforced

Write for Bulletin 3.

THE ANGLE COMPUTER CO.

1709 Standard Ave. ● Glendale 1, Calif.

New

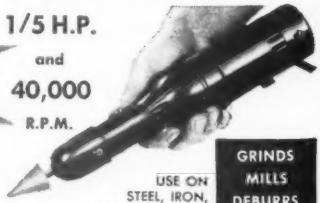
PRECISE 40

1/5 H.P.

and

40,000

R.P.M.



GRINDS
MILLS
DEBURRS
ENGRAVES
POLISHES
FINISHES

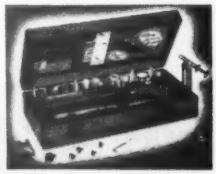
USE ON STEEL, IRON, BRASS, BRONZE, PLASTIC, WOOD AND OTHER MATERIALS.

Speed with power with precision—that's the new PRECISE 40. Surpasses our own PRECISE 35 which outworked every tool in the field. In strong, light plastic case, PRECISE 40 weighs only 40 oz.—packs a record 1/5 H.P. New type quill mounts precision collet chuck or grinding wheel arbors of various sizes; push-button spindle lock for quick tool change. 90% greater cooling; four oversize ball bearings. Quickly lubricated by pressure gun through ball-valve inlets. Tool mounts in vise, lathe, stand, or milling machine or can be used with PRECISE accessories for special applications. Guaranteed shockproof without ground wire.

SEND FOR IT

PRECISE PRODUCTS CO.
7341 CLARK ST., RACINE, WIS.

PRECISE 40



"Fluidmotion"*

RADII & ANGLE DRESSERS

3 MODELS

for just about every wheel dressing requirement

Just ONE setting per form

Just ONE continuous motion

J&S TOOL CO. 477 Main St. East Orange 4, N. J.

Representatives in Principal Cities

• Prominent users tell us they consider "Fluidmotion" Radii and Angle Dressers the finest precision dressing instruments procurable — regardless of cost. They obtain greater accuracy, longer wheel life, and much faster set-up and operation.

We'll be glad to send you complete information. Write.

"Fluidmotion"

FEATURES:

.0001" accuracy
Automatic Centering
"Fluidmotion" dressing
Dustproof and chatterless
Hardened stainless steel
7" and 14" wheel capacities
Highest quality diamonds

**Reg. U. S. Pat. Off.*

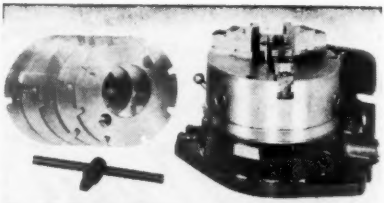
M·B MODEL UTR 60,000 RPM

"UTILITY" Pneumatic
GRINDER

A powerful, fast-cutting tool, streamlined in design, easy to handle. Designed for real production work and the toughest jobs. Precision made, excellent balance. Special grease-sealed bearings . . . no lubrication required. Fitted with steel housing, a special safety feature.

Representatives in Principal Cities
PROMPT DELIVERIES

M·B PRODUCTS
130-134 E. LARNED STREET
Detroit 26, Michigan



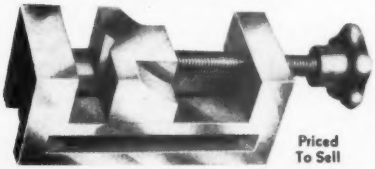
Super-Spacer and Equipment

Greater Speed With Accuracy
HARTFORD "SUPER-SPACER"

So many different jobs can be done more economically with the Hartford Super-Spacer that it will pay you to investigate its possibilities for your shop. Standard equipment includes mask plates, reversible jaw self-centering chuck, sliding handle chuck wrench. It's moderate in cost. Write for illustrated applications bulletin.

THE HARTFORD SPECIAL MACHINERY CO.

TOOLMAKERS'
PRECISION VISES



Priced To Sell

JOSEPH B. FAKES & COMPANY
1415 ETOWAH AVE. ROYAL OAK, MICH.

Accurate Hole Transfer Made Easy With
NIELSEN TRANSFER SCREWS

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduces time and eliminates spoilage of other methods. 7 sizes U.S.S. Inexpensive — Last for years. Write for Circular.

NIELSEN TOOL & DIE COMPANY
1986 W. Eleven Mile Rd.
Berkley, Mich.

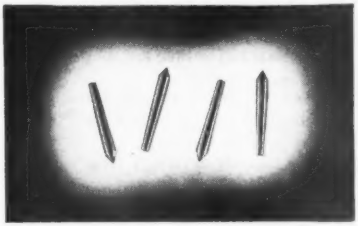
Make LIGHT WORK of HEAVY DIES!

You can do it—economically, too—with a BARRETT LIFTING TABLE. Lifts and lowers heavy dies by simple crank operation. Provides easy conveying on smooth-rolling, heavy-duty casters. Cuts costs, cuts time, safeguards men and dies. Two capacities, 2000 and 3000 lbs. Write for full details!

BARRETT-CRAVENS COMPANY
3269 West 30th Street, Chicago 23, Illinois
Representatives in all Principal Cities
Canadian Licensee: S. A. Armstrong Ltd., Toronto

PRECISION PARTS

PRECISION CENTER



Precision-formed parts require precision-made centers, custom-built to fit special machinery. Those shown here are typical of the fine precision work Ace delivers on small parts and assemblies. Here you will find the complete modern facilities and the managerial know-how to turn out such parts quickly, accurately. Send sample, blueprint or sketch for prices.

RELY ON ACE FOR PRECISION GRINDING Centerless, Internal Cylindrical, External Cylindrical, Blanchard Surface, Plain Surface, and Thread Grinding.

PRODUCTION MACHINING Turning, milling, drilling, cutting, tapping, and threading of small machine parts that require precision grinding—on a mass-production basis.

METAL STAMPING Blanking, forming, and extruding of small metal parts on presses up to 75-ton capacity. Spot welding, sub-assemblies and assembly of intricate radio and machine parts.

HEAT TREATING Electric and gas furnaces, individually pyrometer controlled, for high-heat, quenching, and carburizing of parts up to approximately 10"x10"x15".

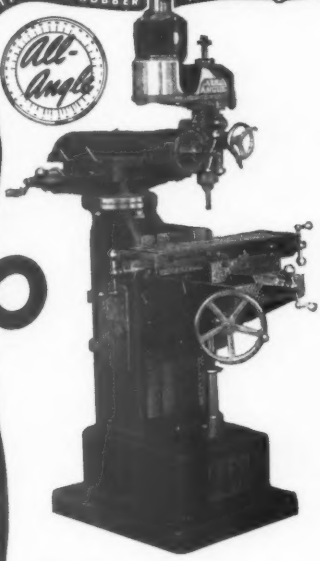
TOOL AND DIE WORK All operations for the production of Punches and Dies for small stampings, for Jigs, Fixtures, Gages, Moulds, Form Blocks, Tool Bits and Circular Form Cutters.

ACE
TRADE MARK

ACE MANUFACTURING CORPORATION
for Precision Parts
1217 E. ERIE AVE., PHILADELPHIA 24, PA.

FLEXIBILITY OF A RUBBER HOSE!

All-Angle



Fray

PRECISION RAM TYPE NO. 7-B
VERTICAL UNIVERSAL
MILLING MACHINE

- Flexible
- Sturdy
- Universal
- Easy to operate
- One set up
- All angles quickly obtained

- Four Sizes
- Four Types
- Adaptable to all Milling Machines

For further information write Dept. M

NATIONAL DISTRIBUTORS
H. LEACH MACHINERY CO.
387 CHARLES ST. PROVIDENCE 4, R. I.
AGENTS IN ALL PRINCIPAL CITIES

Aye,

AND FOR PENNIES

Small holes, .004" to 5/16" in all drillable materials, are easily, quickly and accurately obtained with the Hamilton "Varimatic" Super Sensitive Variable Speed Drilling Machine. Horizontal work capacity to the center of 10". Vertical travel of self-contained drilling unit on column, 6½". Speed range from 840 to 9300 R.P.M.

SPEEDY • FLEXIBLE • ACCURATE

80 PER CENT OF PRESENT INSTALLATIONS ARE REPEAT ORDERS

The Hamilton "Varimatic" will also do your job. And do it better, faster, more accurately. Aye, and for pennies.

Write now for illustrated literature, specifications and price list. You'll be glad you did! Address Department C.

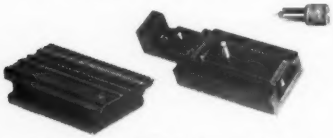
THE *Hamilton* TOOL COMPANY

SUPER SENSITIVE DRILLING MACHINES
TAPPING MACHINES · PORTELVATORS

NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A

DIXIE
Tools & Gages

Produced to your specifications



Precision Tools of Enduring Quality
Accurate Gages for Close Tolerances

Prompt Delivery Anywhere in the U. S.
Write Dept. T for information

Tool & Gage Division
DIXIE TYPE & SUPPLY CO.
1712 Warrior Rd., Birmingham 8, Ala.
Territories Open for Manufacturers' Agents

DIAMOND IMPREGNATED

HONES

(Sintered Steel Bonded)

The life of carbide tools can be prolonged by lengthening the interval between regrinds. And this can be accomplished by touching up such tools lightly with FS Diamond Hones.

FS Diamond Hones are also recommended for shaping special contours on carbide form tools, where diamond grinding wheels do not suffice.

Hone is 6" long overall—diamond section being 1¼" x ½". For best results a 325-400 grit is recommended, and FS Diamond Hones are so stocked. Other grits from 100 to 600 also available.

Write for further particulars.

FISH-SCHURMAN CORPORATION
230 East 45th Street, New York 17, N. Y.

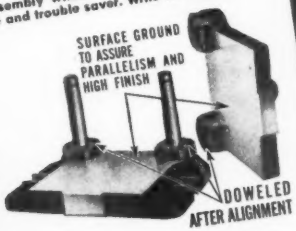
Fish-Schurman

BAUMBACH

35 YEARS OF DIE SET MAKING

THE DIE-SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.



E. A. BAUMBACH MFG. CO.
1814 S. KILBOURN AVE. CHICAGO 23, ILL.

MILL IT ON YOUR LATHE

WITH A **PALMGREN**

MILLING ATTACHMENT

Now — you can do milling, slotting, grinding, grooving, squaring shafts, sawing at angles, and many other important operations on your lathe. PALMGREN MILLING ATTACHMENT is a necessary fixture for small shops, schools and emergency work in large plants. Fits South Bend, Atlas, Craftsman, Logan, Sheldon and all other makes. It has graduation for rotary angle adjustments, also graduated feed and adjustment screw. Easily mounted by straddling lathe's regular tool post. Try one—it will quickly pay for itself.

No. 250

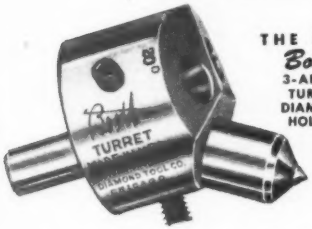
IMMEDIATE DELIVERY

Nos.	Width Jaws	Depth Jaws	Jaws Open	Weight Pounds	Fits Tool Post	Price F. O. B. Factory
150	1½"	1"	1⅝"	6½	1" Dia	$18.75
250	2½"	1" 16"	2½"	11	1¼" Dia	24.75
400	4"	1½"	4"	25	2" Dia	39.75

Order from your dealer or jobber.
Write for circular No. 350.

CHICAGO TOOL AND ENGINEERING CO.
Mfrs. of PALMGREN PRODUCTS for Over 25 Years
8389 South Chicago Avenue - Chicago 17, Illinois

WANT BETTER GRINDING? SHARPER DIAMONDS? FEWER DRESSINGS?



THE NEW *Booth* 3-ANGLE TURRET DIAMOND HOLDER

Put the new Booth 3-Angle Turret Diamond Holder on that "finish" dressing job and see how it improves the cut of your wheel. See the automatic, self-leveling action maintain the diamond point at a fixed level with 30°, 20° and 10° drag angles. 3 drag angles give 3 cutting points—double diamond life—reduce re-sets. 3 Angles assure a sharp, clean—cutting diamond—make dressings accurate, improve grinding—save diamonds, save wheels, increase production.

Available on a rental basis of $2.00 per month, payable six months in advance. Rental includes Turret, Block, Adapter Rod, maintenance, repairs, and engineering installation service. Satisfaction guaranteed. (Give make, type and size of grinder when ordering.) Specify Booth Turret equipment on your new grinders.

Loc-Key-Set Diamonds (Common 12.00 Carat, Medium 24.00 Carat, Select 48.00 Carat) mounted to fit Turret. Specify Carat size and Quality in ordering.

Turret Holder with Adapter Rod

Turret mounted on Block for Surface Grinders

DIAMOND TOOL CO.
(NOT INC.)
Sheldon M. Booth, President
938 E. 41st St. - Chicago 15, Ill.
Customers' Overnight Quarters

Quick Acting

Johnson

FURNACES

JOHNSON HI-SPEED No. 130-A for LOW COST HEAT TREATING HIGH SPEED STEELS . . . .

4-Burner
$295.00

6-Burner
$325.00

F.O.B. Factory

Firebox 7¾" high 13" wide 16½" long

•

Write for complete Johnson Catalog

A large sized toolroom unit for quick, accurate heat treating high speed steels and cutting tools. Reaches operating temperature FAST to save time and gas. Counterbalanced door opens upwards. Insulating refractory lined. 4-Burner unit delivers 1400 to 2350° F to heat treat ANY steels. 6-Burner unit operates between 1800 to 2400° F for high speed steels exclusively. Complete with Carbofrax Hearth, G.E. Motor and Johnson Blower.

JOHNSON GAS APPLIANCE CO.
575 E Avenue N.W., Cedar Rapids, Iowa
Please send FREE JOHNSON Catalog.

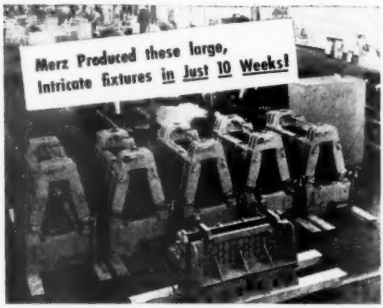
Name .....

Address .....

City .....Zone .....

State .....

Speed and Precision go hand in hand at Merz

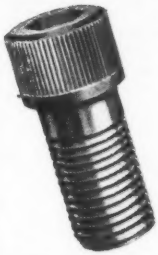


If yours is a problem of obtaining high-precision fixtures or tools—*in minimum time*—here's news! MERZ produced these six intricate drill jigs for horizontal Natco set-ups—complete with patterns, equipment and castings—*in just 10 weeks.* What's more important, these jigs were built to the highest precision standards for drilling, reaming and counter-boring cylinder blocks and drilling and counter-boring an oil pan. This is a typical example of the fast, accurate work being done daily at MERZ—*where speed and precision go hand in hand.* MERZ designs and produces standard A.G.D. and special gages, tools, dies and experimental machines. Write for full information today.

WATCH FOR SPECIAL ANNOUNCEMENT SOON ON NEW MERZ AIR GAGES!

MERZ *Engineering Company* INDIANAPOLIS 7, INDIANA

MECHANICS PREFER IT...



UNBRAKO Knurled Socket Head Cap Screw

Reg.U.S.Pat.Off.

And no wonder! For the knurled head of the "Unbrako" Socket Head Cap Screw affords a slip- and fumble-proof grip even for the oiliest fingers. Thus, it saves time, tempers, and trouble... and can be screwed-in faster and farther before it becomes necessary to use a wrench. In sizes from No. 4 to 1½"; write for the "Unbrako" Catalog.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

Knurling of Socket Screws originated with "Unbrako" in 1934.

"HALLOWELL" KEY KITS... are modern MUSTS wherever socket screws are used. The hollow handle of Celanese* plastic contains the necessary interchangeable key-bits of superior alloy steel. Bits chucked as shown, when used. Their everyday and everywhere usefulness has made them immensely popular.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 600

BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

Do The TAPS You're Now Using Give You These 5 EXTRA ADVANTAGES?

1. **Cold-Temper** ● — **Threadwell** High Speed Taps are given deep-freeze treatment at 120° below zero to make them stronger but less brittle. They produce clean, accurate threads and more per tap—in steels, cast iron, alloys, plastics, etc.

2. **"i-dot-ification"** ● — **Threadwell** Taps have a **red** dot on the shank to identify cut thread, **white** dot on commercial ground, **blue** dot on precision ground. You know instantly that the tap fits the job.

3. **Tap-Capsule** ● — **Threadwell** Ground Thread Taps come in neat metal-capped, transparent plastic tubes that protect these tools against dirt and damage yet permit ready selection of type and size without unwrapping.

4. **Greaseless Rust-Proofing** ● — **Threadwell** Taps are always clean and dry, ready for instant use, yet always bright and shining.

5. **"Personal Attention" To Your Tap Needs** ● — **Threadwell's personal attention** policy applies to every order—at the factory and at the Threadwell distributor in your locality, for he has been carefully selected to provide prompt, intelligent attention to your needs. **Next time, specify Threadwell Taps and get the benefit of these five extra advantages.**

Threadwell products are sold exclusively through Mill Supply Distributors.

Distributors in Leading Industrial Centers Throughout the United States and the world

Threadwell "TAPS OF DISTINCTION"

THREADWELL TAP AND DIE COMPANY · GREENFIELD, MASSACHUSETTS, U. S. A.

CALIFORNIA OFFICE, THREADWELL TAP & DIE CO. OF CALIF., 1322 SANTA FE AVE., LOS ANGELES 21

Die Cut Parts at Low Prices

Small, irregular shaped parts stamped, formed, pierced or extruded to your specifications.

"One to 30,000 Pieces" made with temporary or Semi-Permanent Dies.

For firm quotations to any point in the United States, send us your prints and specifications.

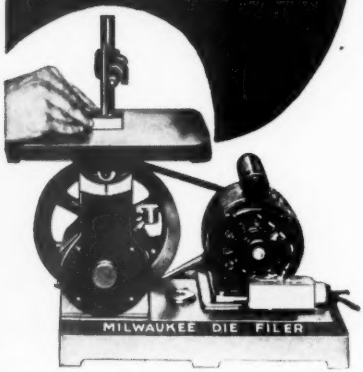
Quick Delivery

WLS STAMPING COMPANY

Short Run Stampings

3290 East 80th Street
Cleveland 4, Ohio

Reduces Die Costs!

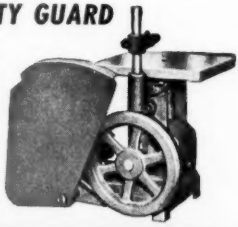


The following "Economy Factors" make the Milwaukee Die Filer a real "Cost Cutter" for Tool, Die and Machine Shops, Foundries, Manufacturing Plants:

- Low First Cost
- Low Operating and Maintenance Costs
- Quick changeover from sawing to filing or vice-versa
- Instant inspection of internal filing or sawing
- Precision workmanship on filing, sawing or lapping operations

NEW SAFETY GUARD

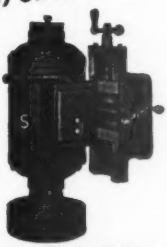
One-piece, all-metal guard now available to all owners and purchasers of the Milwaukee Die Filer, at slight extra cost. Easily installed, it gives operator complete protection, yet does not interfere with speedy shifting of drive belt.



Milwaukee
CHAPLET & MANUFACTURING CO.
1029 S. 40th ST., MILWAUKEE 4, WIS.

"RIGHT! YOUR MACHINE TOOL CAN NOW SERVE YOU AS A (STANDARD) GRINDER TOO."

YES SIR! You can now make your machine a "double purpose" machine, the "Standard Way". STANDARD VERTICAL SPINDLE GRINDERS can be easily mounted on your Planers, Boring Mills, Shapers, Milling Machines, etc., giving you added profits! Available with or without feeds as preferred.



Write for Your copy of Catalog 43, today

The STANDARD ELECTRICAL TOOL Co.

CINCINNATI 4, OHIO

Mt Hope & Sixth St.

DIAMONDS FOR WHEEL DRESSING TOOLS

DIAMONDS FOR THREAD GRINDING TOOLS

DIAMONDS FOR ALL INDUSTRIAL PURPOSES

KOEBEL

KOEBEL DIAMOND TOOL CO.
9456 Grinnell Avenue, Detroit 13

Complete

GEAR PRODUCTION EQUIPMENT

for Cutting, Finishing, Lapping and Checking

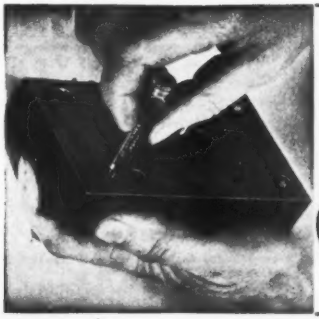
MICHIGAN TOOL COMPANY

7171 E. McNichols Rd. Detroit 12, Mich.

HARDNESS TESTING

has been done with the SCLEROSCOPE since 1907

THE SHORE INSTRUMENT & MFG. CO., INC.
9825 Van Wyck Avenue
Jamaica, N. Y.



A REAL HELPING HAND

It's a help that die makers, tool makers, machinery builders and general machinists have long sought—a more accurate and surprisingly faster way of transferring blind screw holes.

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in 3/16" to 1" diameters.

Send for price list.

HEIMANN MFG. CO.
Dept. T
Urbana, Ohio

ARMSTRONG

DROP FORGED "C" CLAMPS

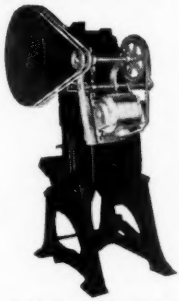
For "C" Clamps that never spread, that never spring or loosen . . . . for unequalled stiffness, strength, and holding power . . . . for years of dependable service, for the finest clamps made, specify ARMSTRONG "C" Clamps.

Specify ARMSTRONG "C" Clamps for highest quality, improved designs for handier, stronger, drop forged, heat treated "C" Clamps with special analysis steel screws.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
340 N. Francisco Ave. Chicago 12, U.S.A.
Eastern Whse. and Sales:
199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office:
1275 Mission St., San Francisco 3, Calif.

MODERNIZE

with
"Modern Motor Drives"



Direct drive units available for practically every type and model machine tool.
Save floor space, power, and lineshaft expense. Moderate Cost. Prompt Delivery.
Write for circular today

MODERN MOTOR DRIVES DIVISION
The Nichols Engineering Company
2400 W. Madison St., Chicago 12, Ill.
Dept. MD

CLEVELAND INDEXING HEAD

Holds all Straight or Taper Shank Tools from 1/16" to and including 1 1/2" diameter

360° Graduations In Three Planes

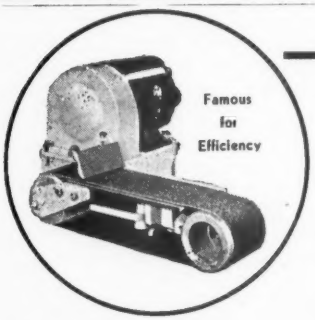
Write for Catalog.

GRINDERS & FIXTURES, Inc.
1261 W. 4th Street -:- Cleveland 13, Ohio

New Nesting Type TOTE PANS

20" Long x 12" Wide x 6 1/4" Deep
16 Ga., drag holes, handles both ends.

J. L. LUCAS & SON, INC.
BRIDGEPORT 5, CONN.



• *HIGH SPEED GRINDING* •

STANDARD D-4 ABRASIVE BAND GRINDER

This new, streamlined bench type grinder assures fast, quality finishing on metals, plastics, wood, fibre . . . at low cost. Built to machine tool specifications, Standard D-4 is equipped with improved band tension control and specially designed protective motor hood. 4x36 1/4" band. The ideal portable unit!

Other styles and sizes in New Manual on Finishing — Write Today

WALLS SALES CORP.
306 E. 38th Street New York, N. Y.

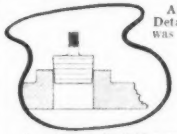
Columbia TOOL STEEL

FORMITE
C .35. W 13.50. Cr 4.00
HIGH TUNGSTEN
HOT WORK DIE STEEL
Highest Resistance to Heat
of all Hot Work Tool Steels
For
Hot Forming - Hot Blanking
Hot Heading - Hot Punching
It Pays to use Good Tool Steel

COLUMBIA TOOL STEEL COMPANY

ARTHUR T. LEMAGE, PRESIDENT
MAIN OFFICE AND WORKS
410 EAST 14TH STREET - CHICAGO HEIGHTS, ILL.

A New Detail Pass Gage For Rapid Visual Checking Hole Sizes



As new as tomorrow, the Detail Tapered Pass Gage was developed for rapid visual checking of hole sizes in jig boring. This new gage eliminates time-consuming caliper and micrometer checking operations.

Toolroom, inspection and internal grinding departments find Detail Pass Gages indispensable cost cutters for quick visual checking or inspection of holes.

The Standard Detail Pass Gage Plug Set

13 plugs from ¼" to 1" in $\frac{1}{16}$" steps. Entering end of each plug .005" under nominal dimensions. Lines clearly indicate .001" steps progressively to top of gage or finish size.

A total of 65 sizes (13 plugs).

Plugs arranged in handy container, clearly numbered. Price—$25.00 per set F.O.B. Detroit. Other sets available which run from 1" to 2" in diameter.

Territories Open for Representatives

DIEMAKER SUPPLIES COMPANY

2679 East Grand Boulevard, Detroit 11, Michigan

KNOW THESE VICTOR BENEFITS...

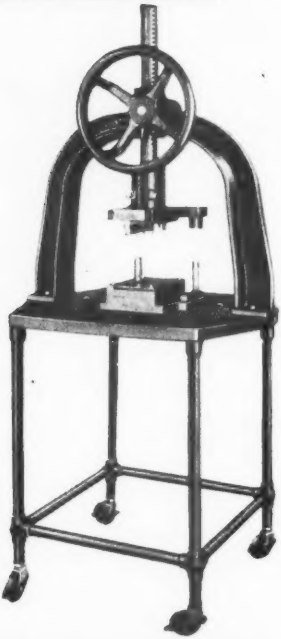
1. Keen, sharp teeth, hardened to cut deep and wear longer
2. Accurate set provides ample clearance and accuracy of material being cut
3. Finest grade of high speed steel, scientifically heat-treated gives VICTOR Blades longer wearing and cutting qualities
4. Large, easy to read markings, on all VICTOR Blades make it a simple job to choose the correct blade type for every job.
5. Complete metal cutting instructions are given in this FREE VICTOR Metal Cutting Handbook. Send for a copy today. Victor Saw Works, Middletown, N. Y.

Sold Exclusively Through Distributors

VICTOR

Makers of hand and power hack saw blades, frames and metal cutting band saw blades.

COMPLETE THE DIE-SET AT YOUR BENCH



LACEY DIE-SET MACHINE

Here is a truly "one man" press that operates with one hand and under full manual and visual control.

Handy for tool and press rooms, it permits the diemaker to complete a die-set *right at his bench* . . . saves tool room and handling costs.

Positive, true punch-to-die alignment is assured at all times, thanks to the Lacey's sturdy, open construction. And punches can be removed as often as needed without disturbing alignment once the die-shoe is clamped to the table and punch holder fixed in position in the ram. No pry bar or hammer is needed to separate punches.

The Lacey Die-Set machine is sensitive for delicate work yet rugged enough for fitting up heavy die-sets. Useful, too, for shearing certain types of punches.

Write today for complete details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
740 Union Ave. Bridgeport 7, Conn.

(Continued from Page 106)

have ever seen for purposes of comparison. The Norton Company of Worcester, Massachusetts, make an excellent set of surface roughness standards depicting various grinding finishes that are also the original machined samples.

In the field of replica standards there are several manufacturers: General Electric Company, Schenectady 5, New York; U. S. Rubber Company, Electroforming Dept., Detroit, Michigan; Surface Checking Gage Company, Hollywood 28, California; Sav-Way Industries, Detroit, Michigan; N-H Gage Company, North Hollywood, California.

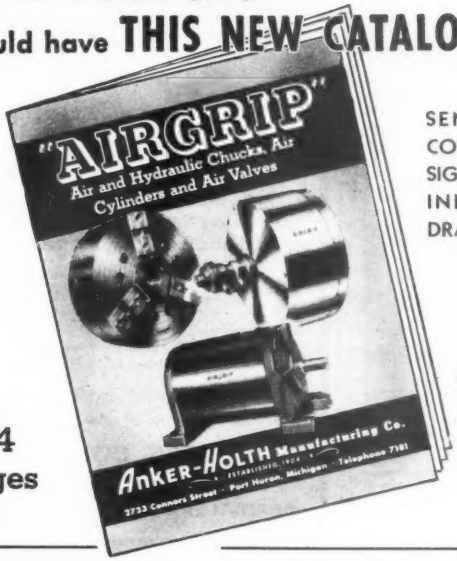
These replica standards have many advantages. Their lower cost permits a wider distribution, hence it is easier for all personnel along the line to check conformance with surface finish requirements. The engineer, inspector, machinist, assembler and everyone connected with the control of surface quality can easily, by fingernail comparison of the parts with the samples, tell if the parts are satisfactory insofar as surface finish is concerned.

Comparison is made by drawing the sharp fingernail lightly across the surface of the standard roughness specimen prepared by a similar process and then across the machined surface of the part whose roughness limits are being checked. It is easy to tell which of the two surfaces is the rougher.

Surface finish measurement instrumentation has already contributed a great deal toward the improvement of the science of interchangeable manufacture. With proper application, it can easily contribute a great deal more.

DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Pa.

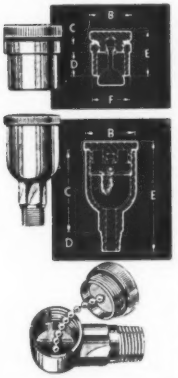
EVERY TOOL SHOP
Should have THIS NEW CATALOG


"AIRGRIP"
Air and Hydraulic Chucks, Air Cylinders and Air Valves
ANKER-HOLTH Manufacturing Co.
ESTABLISHED 1904
2733 Connors Street · Port Huron, Michigan · Telephone 7181

SENT UPON REQUEST—
CONTAINS ESSENTIAL DESIGN DATA ON AIR CYLINDERS and AIR or HYDRAULIC CHUCKS, etc.

64 pages

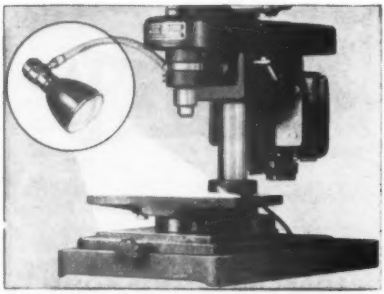
ANKER-HOLTH MFG. CO.
2735 CONNORS STREET
PORT HURON, MICHIGAN



- Covers Anchored—can't drop or lose
- Tops gasketed for vapor-tight closure
- Threads are die cut for snug fit.
- Knurled tops for convenient removal

Styles "RS", "AS", "ASA" and "STG" Oilers, although standard stock items, are somewhat of a specialty They are particularly adapted for revolving, mixing or agitating equipment —in food processing and similar applications requiring rigid sanitation—also for chemical and other industries having harmful vapors or excessive dust conditions Available in a range of capacities. Ask for catalog No 60 presenting complete line of lubricating devices

GITS BROS. MFG. CO.
1845 South Kilbourn Avenue, Chicago 23, Illinois
Exclusive for over 35 years



VIMCOLIGHTS
CUT COSTS WITH SHARPER SIGHT

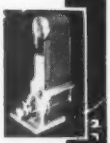
Faster, more accurate work results when VIMCOLIGHT'S clear, glareless illumination is focused where it is needed most. Easily adjustable to spotlight all vital working areas, yet stays fixed in any position. Shown above on a Hamilton Tool Co. Drilling Machine.

VIMCO MFG. COMPANY, Inc. 117 BRAYTON ST BUFFALO 13, N.Y.

SANDER ▪ BELT SANDER ▪ BELT SANDER ▪ BELT

Woods Model '40'

FOR METALS, WOOD, GLASS, PLASTICS AND RUBBER. CAN BE OPERATED IN HORIZONTAL OR VERTICAL POSITION.



SANDER COMPLETE WITH BELT AND WORK DAM $39.95

BALANCED PULLEYS

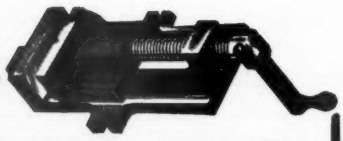
TESTED TO 5000 RPM

A husky, ball-bearing sander and tool grinder, built for maximum efficiency, smooth operation and long life. 5" x 8½" work area, 36" belt. Reversible platen usable on either face. Dealer inquiries invited.

BELT SANDER ▪ BELT SANDER ▪ BELT SANDER

WOODS ENGINEERING CO.

15 WALL ST NORWALK, CONN



YOST DRILL PRESS VISE

This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3¼	4	12¼
2D	5	5½	23

Do you need a vise of ANY type?

Write today for bulletins on the extensive Yost line

YOST MFG. COMPANY

1000 MAIN ST.

MEADVILLE, PENNSYLVANIA

1846 One Hundred Years of Continuous Service to Industry **1946**

HY-TEN

SAE AISI

ALLOY STEELS

A century of experience in the development and application of special steels for PRODUCTION, TOOL ROOM, MAINTENANCE.

Seven warehouse stocks of rounds, flats, squares, hexagons, octagons. Forgings to specification.

Write for our data sheet book.

WHEELOCK, LOVEJOY & CO., INC.

138 Sidney Street

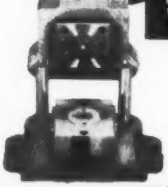
CAMBRIDGE 39, MASS.

Cleveland 14, Chicago 23, Newark 5, Detroit 3, Buffalo 10, Cincinnati 32

If you make .. **WASHERS**

BY ALL MEANS USE

HOVIS UNIVERSAL MASTER WASHER DIES



Once you invest in Hovis Master Dies to meet your requirements,

then these 5 SMALL INTERCHANGEABLE PARTS are all you need to buy to make a new size washer. →

Eliminate the cost of complete new dies. *Write for literature*

HOVIS SCREWLOCK COMPANY

8100 E. Nine-Mile Road, Van Dyke, Mich.

Phone: Centerline 1575 (Suburb of Detroit)

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ COMPANY
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings

★

PRESS BRAKE DIES
and Punching
Attachments for All
Makes of Press Brakes
DREIS & KRUMP MFG. CO.
7428 S. Loomis Blvd. Chicago 36, Ill.

★

ROCKFORD DIE & TOOL WORKS, INC.
1816 Seventeenth Avenue, Rockford, Illinois Phone MAin 3084. Designers and Manufacturers Tools-Dies-Jigs-Fixtures. Production Job Work

Michigan

DAVIS TOOL & ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan VErmont 5-6000. Tools and Dies. Special Machinery Sheet Metal Stampings and Assemblies

LINCOLN PARK MANUFACTURING CO.
3306 Dix Road, Lincoln Park, Mich., ATlantic 8111. Special high speed circular, dovetail, flat form tool bits. Small machines, jigs, gages and experimental parts. Regrinding and salvaging high speed flat form, special bits and small flat broaches. Attractive proposition for representatives.

New Jersey

THE VIKING TOOL & MACHINE CORP.
6 Main Street, Belleville, New Jersey Tools-Dies-Jigs-Fixtures-Molds-Gages-Machines-Stampings-Specialties

New York

AMERICAN MEASURING INSTRUMENTS CORP.
240 West 40th St., New York 18, N. Y. Jigs, fixtures, gages, dies, precision parts.

CONRAD & MOSER
2-23 Borden Ave., Long Island City, N. Y. Machine Tools & Molds, Parts & Machines, Aluminum Cast Parts, Aluminum Sheet Formed Housings

RANE TOOL CO., INC.
17 Ross St., Jamestown, N. Y., Phone 7-175. Specialists in Blanking, Forming, and Drawing Dies

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave. Cleveland MUlberry 2600
DESIGNERS AND BUILDERS
Jigs & Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

THE DENNING MANUFACTURING CO.
1775-81 E. 87th St., Cleveland, O., CEdar 0801 Designers and Builders of High Grade Dies

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, O., WOodbine 4736 Dies, Tools, Jigs, Fixtures, Light Stampings Special Machinery, Manufacturing

THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, O. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio. WOodbine 2440-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio. Bedford 1234. Tool Makers—Short Run Production Work.

PARAMOUNT TOOL CO.
1392-98 East 43rd St., Cleveland, O., ENdicott 2220. Jigs, Fixtures, Dies, Experimental Work

THE PHOENIX MACHINE CO.
2711 Church Ave., Cleveland, O., CHerry 1048. Contract Grinding, Boring and Planing. Lester-Phoenix Die Casting and Plastic Molding Machines

A. P. SCHRANER & CO.
3838 Payne Ave., Cleveland, O., HEnderson 8644. External Cylindrical Lapping Machines, Special Machinery, Tools, Dies, Jigs, Fixtures.

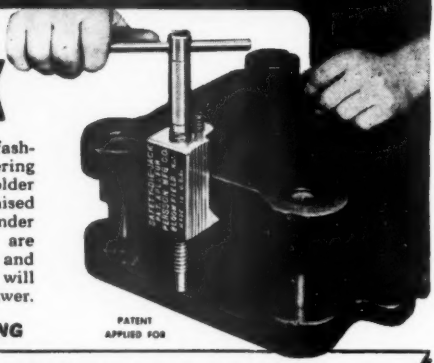
THE VARIETY MACHINE & STAMPING CO.
12695 Elmwood Ave., Cleveland, O., LAkewood 8433. Designers and Manufacturers of Dies, Metal Stampings. 250 tons capacity.

TAMMS LAYOUT DOPE
Comes in Blue, Black, Orange, Red. Dries fast. Oil resistant. Won't chip, crack or flake off. Also ideal as marking dye. Get 8 oz. brush-in-cans, pts., qts., drums. SAMPLE FREE!
TAMMS SILICA COMPANY
228-TD North La Salle St. • Chicago 1, Illinois

NOW YOU CAN SEPARATE AND ASSEMBLE DIE SETS..QUICKLY..EASILY..SAFELY!

with a PERSSON

DIE JACK



These Die Jacks eliminate old-fashioned, unsafe, prying or hammering methods. Just clamp on punch holder and turn handle. Punch holder is raised or lowered smoothly, always under control. PERSSON Die Jacks are precision built from fine steel and alloys—a tool every tool maker will want for his tool box or bench drawer.

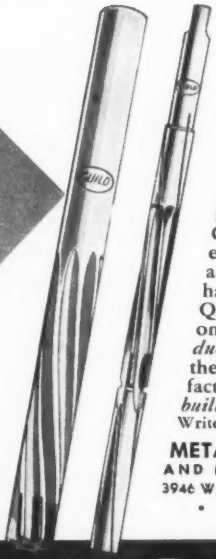
NO PRYING • NO HAMMERING

PATENT APPLIED FOR

PERSSON MFG. COMPANY, 2 HENRY ST. BLOOMFIELD 4, N.J.

GUILD Reamers

HALLMARK OF *Precision* IN THE MANUFACTURE OF *Special Reamers*



HIGH SPEED STEEL
in sizes from .025 diam.

CARBIDE TIPPED
in sizes from .090 diam.

STRAIGHT • SPIRAL • STEP • PILOT • HAND

● GUILD is the new name for an old established line of reamers whose reputation for accuracy has become outstanding in the manufacture of aircraft—motors—engines—small arms—radios—fine instruments, etc. The name GUILD is stamped on each individual reamer as an identification—a hallmark of finest quality. Quality that is possible only by *creative* and *productive* ability far above the average in the manufacture of *reamers specially built for special purposes.* Write for booklet.

METAL CUTTING TOOLS
AND MANUFACTURING CO.
3946 W. Eleven Mile Rd., Berkley, Mich.
• Phone: Lincoln 2-5600 •

What STERLING *is to silver* (GUILD) *is to Reamers*

"THE CURB"

FOR SALE · WANTED · EMPLOYMENT · OPPORTUNITIES

CLASSIFIED ADVERTISING RATES — $2.00 SERVICE CHARGE PLUS 15¢ PER WORD — PAYABLE IN ADVANCE

TOOLS. Dies designed reasonable. Address Box ES-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

WANTED: Medium sized Die Casting machine with or without order for Die Cast parts. Address Box AN-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

WILL BUY AT ONCE—Rowbottom or Garvin Cam Cutting Machine. Address Box PS-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

FOR SALE: Johansson angle block set; metric gage block sets; vernier height gage; bore indicator, etc. Will sell reasonably. Address Box RK-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

WANTED REPRESENTATION: A manufacturer of a new tool room specialty desires local representation. Seeking individuals and organizations willing to do missionary work as well as following up inquiries. Exclusive territories. Good commissions. Address Box RW-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

SALES ENGINEERS: Wanted for New York area, to represent specialized distributor of cutting tools, grinding wheels, and light machine tools and attachments. Must have previous sales experience in this field. Address Box SD-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

You Can Get What You Want—

You Can Sell What You No Longer Need

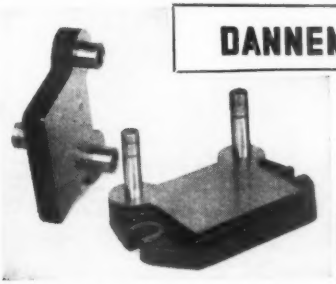
in "THE CURB"

For every business or shop want advertise your needs in "THE CURB"—*Tool & Die Journal's* Classified Section.

WANTED TO BUY: Brown & Sharpe Rotary Gear Cutter, 60" capacity. Address Box BR-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

POSITION WANTED: Engineer with ten years' successful experience in product and tool design. Experienced on pneumatics, gears, die castings, stampings and forgings. Familiar with heat treatments and machine tools. College graduate, ability to take complete charge of engineering. Address Box PE-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.

FOR SALE: No. 100 Micromatic Hydrohoner; Banet Oil Separator; No. 6D Potter & Johnston Automatic Chucking and Turning Machine; No. 7 Fellows Gear Shaper; No. 13 Brown & Sharpe Universal & Tool Grinder. Address Box MS-1046, TOOL & DIE JOURNAL, 2460 Fairmount Blvd., Cleveland 6, Ohio.



DANNEMAN *Precision* DIE-SETS

- Even inch punch and die space.
- Shank on center line of punch and die space.
- Machine finished clamping U-lugs.
- Distance of leader pins spread to allow stampings to fall through on inclined press operations.
- Die shoes and punch holders interchangeable.

Write for Catalog

ACME-DANNEMAN CO., INC.
207 Lafayette Street • New York 12

ADVERTISERS' INDEX

Accurate Bushing Co. 139
Ace Abrasive Laboratories 152
Ace Mfg. Corp. 161
Acme-Danneman Co., Inc. 175
Acme Industrial Co. 115
Acme Tool Co. 12
Advance Foundry Co., The 150
Allegheny Ludlum Steel Corp. ..... Inside Front Cover
Allen Mfg. Co., The 50
Allied Products Corp. 148
Alofs Manufacturing Co. 151
American Broach & Machine Co., Div. Sundstrand Machine Tool Co. 53
American Measuring Instrument Corp. 127, 173
Angle Computer Co. 158
Anker-Holth Manufacturing Co. 171
Armour & Co. 51
Armstrong-Blum Mfg. Co. ..... Back Cover
Armstrong Bros. Tool Co. 168
Associated Steel Co. 125
Atlantic Saw Mfg. Co., Inc. 67
Atlantic Tool & Engineering Service 173
Atrax Co., The 155
Automotive Maintenance Machinery Co. (AMMCO) 55
Axelson Mfg. Co. 43

Barrett-Cravens Co. 160
Barth Stamping & Machine Works, Inc. 30
Baumbach Mfg. Co., E. A. 163
Bellows Senacon Co. 3
Benton Co., The 143
Boggis & Co., Henry P. 152
Bokum Tool Co. 62
Boyar-Schultz Co p. 154
Bunell Machine & Tool Co., The 46
Burke Machine Tool Co. 156

Carboloy Co., The 145
Carborundum Co., The 36-37
Cardinal Machine Co. 150
Carpenter Steel Co., The 144
Center Scope Products 154
Cerro de Pasco Copper Corp. 114
Chicago Rawhide Mfg. Co. 145
Chicago Tool & Engineering Co. 163
Chicago Wheel & Mfg. Co. 29
Cincinnati Milling Machine Co., The 108-109
Cincinnati Shaper Co. 99
Cleveland Crane & Engineering Co. 97
Cleveland Twist Drill Co., The 7
Cleveland Universal Jig Co. 173
Clinton Machine Co. 71
Colonial Bushings, Inc. 156
Columbia Tool Steel Co. 169
Conrad & Moser 173
Continental Tool Works, Div. of Ex-Cell-O Corp. 44
Cooley Electric Mfg. Corp. 52
Cosa Corporation 10
Cratex Mfg. Co. 119
Criterion Machine Works 135
Crucible Steel Co. of America 133

Dahlstrom Mfg. Co. 158
Danly Machine Specialties, Inc. ..... Inside Back Cover
Davis Tool & Engineering Co. 173
Denison Engineering Co., The 24
Denning Manufacturing Co., The 173
Detroit Die Set Corp. 40
Detroit Reamer & Tool Co. 14
Detroit Stamping Co. 59
DeVlieg Machine Co. 20
Diamond Machine Tool Co. 121
Diamond Tool Co. 163
Dickerman Mfg. Co., H. E. 31
Diemaker Supplies Co. 169
Di Machine Corp. 177
Dixie Type & Supply Co., Tool & Gage Div. 162
DoALL Co., The 69
Dreis & Krump Mfg. Co. 173
Dresel-Betz Co. 173
Drive-All Mfg. Co. 153
Dykem Co., The 156

East Shore Machine Products Co. 127
Economy Engineering Co. 61
Evans Reamer & Machine Co. 148

Fakes & Co., Joseph B. 160
Federal Products Corp. 76
Federal Tool Corp. 135
Firth-Sterling Steel Co. 13
Fish-Schurman Corp. 162
Fonda Gage Co. 152
Ford Mfg. Co., Inc., M. A. 63

Gairing Tool Co., The 155
Gas Appliance Service, Inc. 158
Gear Specialties 15
General Die & Tool Co. 173
General Engineering & Mfg. Co., (GEMCO) 28
Genesee Mfg. Co., Inc. 42
Gibson Co., The Wm. D. Div. Associated Spring Corp. 151
Gits Bros. Mfg. Co. 171
Gorton Machine Co., George 23
Greenfield Tap & Die Corp. 48
Grinders & Fixtures, Inc. 168
Grobet File Co. of America 138

Hamilton Tool Co. 162
Hardinge Bros., Inc. 17
Hartford Special Machinery Co. 160
Haynes Stellite Corp., Unit Union Carbide & Carbon Corp. 64
Heimann Mfg. Co. 167
Heinz, Inc., Howard H. 137
Hoggson & Pettis Mfg. Co. 139
Holo-Krome Screw Corp. 5
Hovis Screwlock Corp. 172
Huebner Publications 68

Ideal Tool & Die Co., Inc. 153
Illinois Tool Works 125
Industrial Machine Co., The 173
Ingersoll Milling Machine Co. 103
Inter-State Designing & Tool Co. 154

J & S Tool Co. 159
Johnson Gas Appliance Co. 164

Kiffer Tool & Die Co. 173
Knight Machinery Co., W. B. 32
Koebel Diamond Tool Co. 167

Lafayette Tool & Supp'y Co. 154
Lassy Tool Co. 138
Leach Machinery Co., H. 161
Lempco Products Inc. 58
Lester-Phoenix, Inc. 26
Lincoln Park Mfg. Co. 173
Logan Engineering Co. 21
Lucas & Son, Inc. J. L. 168
Lufkin Rule C., Tht. 121

M-B Products 160
Machinists Tool Grinding Co. 157
Maddison-Kipp Corp. 127
Masonite Corp. 65
McKinney Tool & Mfg. Co. 18-19
Mead Specialties Co. 129
Metal Cutting Tools & Mfg. 174
Meyers Co., Inc., W. F. 57
Merz Engineering Co. 164
Michigan Chrome & Chemical Co. 137
Michigan Tool Co. 167
Milwaukee Chaplet & Mfg. Co. 166
Modern Motor Drives Division, The Nichols Engineering Co. 168
Monarch Machine Tool Co. 45
Moore Special Tool Co., Inc. 137, 170
Munton Mfg. Co. 6

National Machine Tool Co., The 35
National Tool Salvage Co. 114
National Twist Drill & Tool Co., Div. Winter Bros. Co. 25
Nielsen Tool & Die Co. 160
Noble & Stanton, Inc. 113, 146 173
Norton Co. 72-73

Oliver Instrument Co. 144
O'Neil-Irwin Mfg. Co. 140

Paramount Tool Co. 173
Persson Mfg. Co. 174
Phoenix Machine Co. 173
Pratt & Whitney, Div. Niles-Bement-Pond Co. 22
Precise Products Co. 159
Procunier Safety Chuck Co. 115
Production Machine Co. 121
Producto Machine Co., The 38
Putnam Tool Co. ..... Front Cover

R & L Tools Co. 16
Rane Tool Co. 173
Reid Brothers Co., Inc. 130
Roberts Rubber Co., Weldon, Brightboy Industrial Division 119
Rockford Die & Tool Works, Inc. 173
Rouse & Co., H. B. 149
Rusnok Tool Works 129

Sanford Mfg. Co. 149
Schnacke Mfg. Co. 123
Schraner & Co. A. P. 173
Sheldon Machine Co., Inc. 47
Shore Instrument & Mfg. Co. 167
Smit & Sons, Inc., J. K. 49
Sommer & Adams Co., Subsidiary The Federal Machine & Welder Co. 74
South Bend Lathe Works 39
Springfield Machine Tool Co., The 56
Standard Electrial Tool Co. 167
Standard Pressed Steel Co. 165
Star Machine & Tool Co. 33
Strand & Co., N. A. 157
Strong, Carlisle & Hammond Co. 123
Sunnen Products Co. 41
Super Tool Co. 27

Tamms Silica Co. 173
Taylor Machine Co. 154
Thermo Electric Mfg. Co. 110
Thompson & Sons Co., The Henry G. 66
Thomson Industries, Inc. 54
Threadwell Tap & Die Co. 165
Timesaver Products Co. 147
Tools & Gages, Inc. 107
Tubular Micrometer Co. 143

Ulmer Co., The J. C. 8-9

Variety Machine & Stamping Co. 173
Victor Saw Works, Inc. 169
Viking Tool & Machine Corp. 173
Vimco Mfg. Co., Inc. 171

W. L. S. Stamping Co. 166
Walls Sales Corp. 168
Watts Bros. Tool Works 170
Webber Gage Co. 34
Welding Equipment & Supp'y Co. 70
Wheelock, Lovejoy & Co., Inc. 172
Whistler & Sons, Inc., S. B. 178
Wilson, K. R. 11
Woods Engineering Co. 172

Yost Mfg. Co. 172
Young Arbor Co. 147

Meet Production Demands

DIEBEL **HI** $\frac{550}{RPM}$ **SPEED** PUNCH PRESS

Small Metal Stampings

TERMINALS — LUGS — WASHERS, ETC:

THIS SMALL

Accurate Punch Press Provides Speed and Economical Production

THINK

Up to 550 Strokes per Minute and Fully Automatic

IDEAL FOR PLASTICS — PAPER — FIBRE

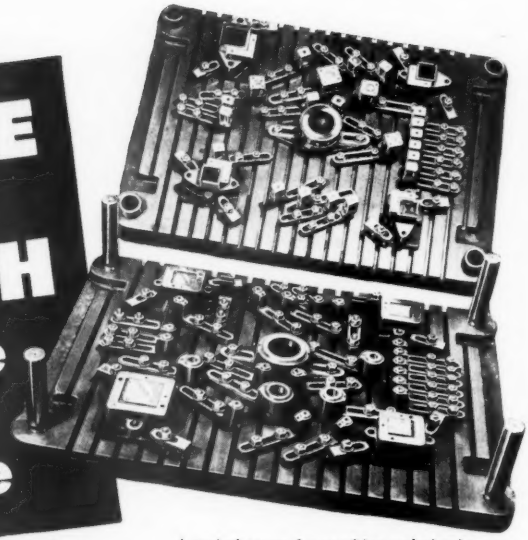
Write Immediately for Full Particulars

DI MACHINE CORPORATION

Division of Diebel Die & Mfg. Co.

2708 W. Irving Park Road, Chicago 18, Illinois

PIERCE and NOTCH at the same time

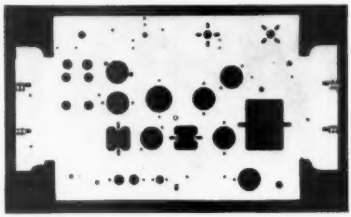


A typical set-up for notching and piercing.

with

WHISTLER
MULTI-USE Adjustable Dies

Pierced and notched with Whistler multi-use adjustable dies.



You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.

Whistler multi-use adjustable dies are available from stock...a day or two from your plant...in all standard sizes from 1/32" to 3" diameters...round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

Re-arrange Whistler multi-use adjustable dies in as many different set-ups as your production calls for...you actually make up die sets from units in stock and reduce costs per job to an unbelievably low figure. All parts of like size are interchangeable.

Get all the facts on how Whistler adjustable dies can speed *your* production...cut *your* costs. Write today for the Whistler Catalogs.

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, N. Y.

WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

THE OFFICE OF TOMORROW

is on the Press Today

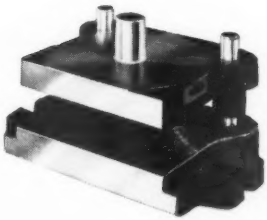
The clean lines and rounded contours of modern office furniture and equipment—the innumerable duplicated parts in typewriters, calculators and other office machines are ideally suited to Press Production. The Punch Press is the best and fastest method of duplicating parts for the vast field of industrial and business machines; and the entire Stamping Industry recognizes Danly Die Sets as vital in speeding die making programs, press production, and eliminating "downtime" because Danly means *known dependable accuracy.*

DANLY MACHINE SPECIALTIES, INC.
2100 S. 52nd Avenue • Chicago 50, Illinois

DANLY *National Assembly*

Call Danly

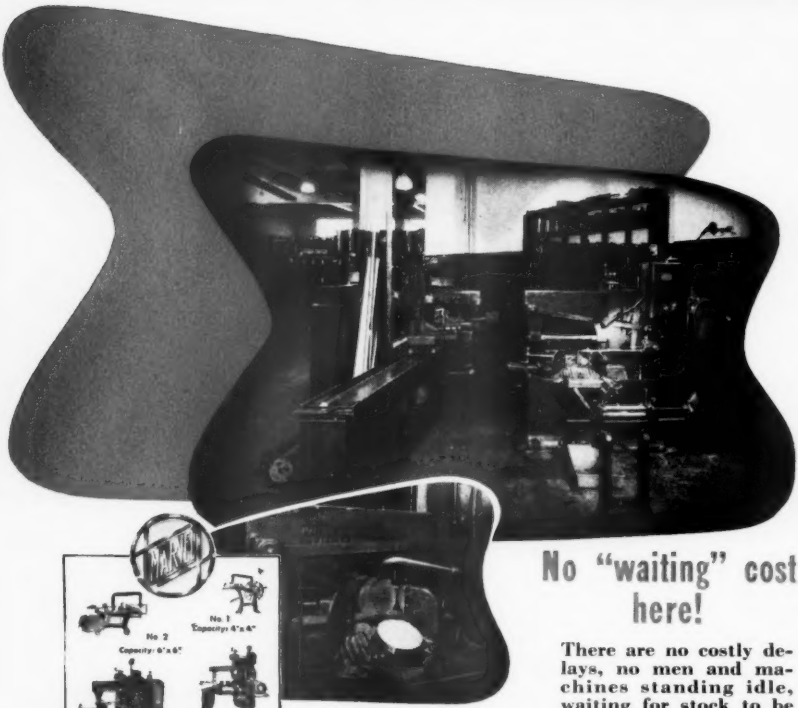
- **MILWAUKEE 2** 111 East Wisconsin
- **DETROIT 16** 1549 Temple Avenue
- **CLEVELAND 14** 1550 East 33rd Street
- **DAYTON 2** 900 East Monument
- **ROCHESTER 4** 16 Commercial Street
- **PHILADELPHIA 40** 3858 Pulaski Avenue
- **LONG ISLAND CITY 1** 47-28 37th Street
- **DUCOMMUN METALS & SUPPLY CO.** 4890 South Alameda, Los Angeles

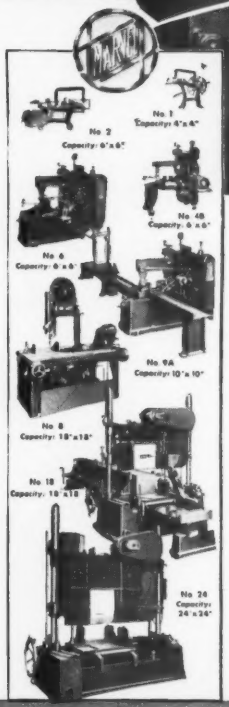


DIE MAKERS SUPPLIES

DANLY DIE SETS

Welded Steel Fabrication





No "waiting" cost here!

There are no costly delays, no men and machines standing idle, waiting for stock to be cut off from bars, when the stockroom is equipped with a No. 6A or 9A MARVEL High Speed Sawing Machine.

These *fast*, all-ball-bearing high speed saws will cut off accurate lengths or slices at almost unbelievable speed. Equipped with an automatic bar push up, they will cut identical pieces from single or nested bars automatically, with no more operator attention than an automatic screw machine. Still, at any point, the automatic operation can be interrupted, a miscellaneous cut made, and the "production" run resumed by simply re-engaging the bar feed. A single MARVEL Automatic can keep well ahead of a large machine shop, increasing the earning time on all machines. There is a MARVEL Saw for every need—in every capacity range and price class. Your local MARVEL Sawing Engineer will gladly study your metal sawing problems and requirements and make recommendations as to methods and equipment. *Send for Catalog.*

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.